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Job Performance Report, Project F-73-R-9
Subproject IV: RIVER AND STREAM INVESTIGATIONS
Study V: Wood River Fisheries Investigations
Job 1: Fish Distribution, Abundance, and Movements
Job 2: Angler Use, Harvest, and Opinions
Job 3: Evaluation of Angling Regulations
Job 4: Assessment of the Impacts of Irrigation Diversions
Job 5: Assessment of the Impacts of Stream Channelization and Snag Removal

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JOB PERFORMANCE REPORT

State of: Idaho Name: RIVER AND STREAM INVESTIGATIONS

Project No.: F-73-R-9

Subproject No.: IV Title: Wood River Fisheries Investigations

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ABSTRACT

The Big Wood River formerly supported a high-quality wild rainbow trout fishery. Since the 1940s, man-induced changes have extensively altered trout habitat in the drainage. As development of the drainage proceeded, recreational opportunities also resulted in increased angling pressure. As a result of these changes, the fish population declined.

In 1986, we began evaluating the status of fish populations in the Big Wood River. Project goals were: (1) determine what factors may be limiting the population, and (2) propose management direction. Data from the initial year of a multiple-year project is reported herein.

The Big Wood River supports a self-sustaining wild rainbow trout population. Summer densities ranged from 156 to 1,068 trout/km and averaged 587 trout/km and 367 trout/hectare. These densities exceed those in sections of the Big Lost and Portneuf rivers, and Silver Creek. The mean total length of trout sampled in summer was 218 mm; 19.3% exceeded 300 mm and 3.7% exceeded 400 mm.

Native rainbow trout exhibited relatively rapid growth rates that were comparable to those observed in sections of the Henrys Fork Snake River, Silver Creek, and the South Fork Boise River. The trout have sufficient growth potential and longevity to attain a large size. However, very large (>450 mm) and older aged (>age 4) trout are uncommon.

Spawning occurs during spring immediately prior to peak runoff. A portion of the population migrates upstream to spawning sites. Most trout maintained limited home ranges during the summer. Some downstream movement occurred in fall and may be related to winter cover-seeking behavior.

A substantial sport fishery occurs on the Big Wood River. In 1986, anglers fished 29,222 hours on 51 km of the main stem. Effort averaged 572 hours/km, or 163 angler trips/km. Catch rates (fish harvested and released) averaged 1.18 fish/hour. Anglers harvested 12,366 game fish comprised of 65% hatchery-reared rainbow trout and 35% wild rainbow trout. Approximately 17,800 hatchery-reared trout were stocked in census areas and anglers harvested 46%.

A large proportion (65Z) of the total catch was released. Fifty-three percent of the anglers used bait and the remainder used flies and lures. Anglers using flies released 89Z of their catch. Within two sections, anglers voluntarily released nearly 80Z of the catch.

Habitat characteristics profoundly affected trout distribution. Densities of age 1 and older rainbow trout tended to increase as the areas of lateral scour pools, steep riffles, rapids, and plunge pools increased. Trout densities also increased as woody debris cover components increased. Areas with cover components supported eight to ten times larger densities of trout as areas without cover or with riprap.

Annual mortality rates exceeded 70Z in both catch-and-release and general regulation areas. Habitat quality and angler exploitation are influencing mortality rates.

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INTRODUCTION

Historically, the Wood River drainage supported a high-quality rainbow trout Salmo gairdneri fishery and was recognized as one of the premier wild trout streams in Idaho. The drainage contains the largest area and most productive trout waters in south central Idaho (IDFG 1986).

Since the 1940s, man-induced activities have extensively altered trout habitat in the drainage. The most significant channel alterations have included: channel relocation, diking, channel clearance, and riprapping. Concurrent with channel alterations has been loss of riparian habitat. Most activities have been associated with attempts to control flooding, development of floodplain areas, and road construction. Studies conducted in 1967 and 1968 indicated 21 km of stream (22% of the area surveyed) had been altered on the main stem Big Wood River (Irizarry 1969). Extensive channelization in the Big Wood and Big Lost rivers in 1965 initiated an interest in protecting stream channels in Idaho (Irizarry 1969) and ultimately resulted in passage of a law (Section 42-3803, Idaho Code) requiring that "stream channels of the state and their environments be protected against alteration for the protection of fish and wildlife habitat, aquatic life, recreation, aesthetic beauty and water quality."

As a consequence of habitat alterations, fish populations in affected stream reaches declined. Game fish populations sampled in altered reaches of the Big Wood River were one-tenth those in "natural" reaches (Irizarry 1969). Simultaneously, as development proceeded, recreational opportunities in the Wood River Valley resulted in increased angling pressure. The number of fishing licenses sold in Idaho has increased from 220,000 in 1950 to more than 500,000 in 1985 (IDFG 1986). Between 1960 and 1980, Idaho's population increased by 41%. During the same period, the population of the upper Wood River Valley--Bellevue, Hailey, Ketchum, and Sun Valley--has increased by 123% (U.S. Department of Commerce 1984).

With the exception of Silver Creek (Thurow 1978) and Magic Reservoir (Partridge 1985), no intensive fisheries investigations have been conducted in the Wood River Basin. Consequently, information on the fishery resource is incomplete, consisting of limited harvest and population inventory data.

In 1986, the Idaho Department of Fish and Game initiated this intensive fishery investigation of the Wood River Basin. The project is designed to evaluate the current status of game fish populations and define factors that may be limiting the population. Once limiting factors are defined, recommendations will be made to help restore the population. This report includes data from the initial year of a multiple-year project.

OBJECTIVES

Job No. 1: Fish Distribution, Abundance, and Movements

1. To assess the abundance, distribution, and age structure of fish stocks in the Big Wood River and principal tributaries.

2. To characterize movement patterns of the spawning and rearing phases of rainbow and brown trout in the Big Wood River.

Job No. 2: Angler Use, Harvest, and Opinions

1. To estimate angler effort and harvest on selected areas of the Big Wood River.

2. To survey angler opinions and preferences on selected areas of the Big Wood River.

Job No. 3: Evaluation of Angling Perceptions

1. To compare fish populations in general regulation sections of similar habitat with fish populations within the following special regulation sections: Big Wood River--Hulen Meadows to North Fork Bridge; Little Wood River--"Bear Tracks" Williams State Recreation Area.

2. To compare angler effort, catch, and angler opinions within special regulation and general regulation stream sections.

3. To evaluate movements of fish stocks between special regulation and general regulation stream sections.

Job No. 4: Assessment of the Impacts of Irrigation Diversions

1. To assess the impact of unscreened irrigation diversions on fish populations in the Big Wood River.

2. To evaluate the feasibility of screening diversions if they adversely impact fish populations.

Job No.5: Assessment of the Impacts of Stream Channelization and Snag Removal

1. To compare fish populations in channelized and unchannelized stream sections of the Big Wood River and tributaries.

2. To assess the value of logs and woody debris as fish habitats in the Big Wood River and tributaries.

3. To assist in development of criteria for protection of fish habitat during stream channelization and snag-removal projects in the Big Wood River and tributaries.

RECOMMENDATIONS

Curtail stocking of hatchery-reared trout near the Hulen Meadows and Nork Fork bridges. Relocate the stocking sites to reduce straying of hatchery-reared trout into the catch-and-release area.

Conduct an instream flow analysis between Bellevue and the Glendale Diversion. Submit a minimum flow application.

Alleviate the livestock trespass problem on the Little Wood River within Bear Tracks State Park.

DESCRIPTION OF STUDY AREA

The Big Wood River drainage is located in south central Idaho, encompassing portions of Blaine, Camas, Gooding, and Lincoln counties. From its origin near Galena Summit, the river flows south-southwest approximately 99 km to its confluence with Magic Reservoir (Figure 1). Constructed in 1909 for irrigation storage, Magic Reservoir blocks movements of fish populations. Below Magic Reservoir, the Big Wood River flows 89 km to its confluence with the Little Wood River near Gooding. The Malad River forms at this juncture and flows 19 km to its confluence with the Snake River near Hagerman.

The watershed encompasses more than 77,400 hectares and drops in elevation from 3,000 m at its headwaters to 930 m at its confluence with the Snake River. Principal tributaries include Camas, Trail, and Warm Springs creeks and the East and North forks of the Big Wood River. Silver Creek, an internationally renowned trout stream, is a tributary to the Little Wood River.

Maximum stream discharge occurs from April through July and typically peaks in early June as the result of snowmelt from higher elevations (Figure 2). Several significant irrigation diversions affect flows downstream from Bellevue. A primary diversion, the Bypass Canal, and subsequent diversions dewater the riverbed for a 5 to 10 km reach downstream from the Glendale Bridge.

Castelin and Chapman (1972) provide detailed descriptions of the study areas: climate, geography, hydrology, and water quality. Bruns and Minshall (1979) and Platts and Rountree (1974) provide additional descriptions of environmental and biological parameters. Chemical analysis illustrates that the Wood River Basin is composed of productive waters with relatively large concentrations of various ions.

As a result of its geology, the Wood River Basin's fish fauna reflects drainage isolation. Hubbs and Miller (1942) describe the Wood River drainage as exhibiting partial isolation and disruption, with fauna peculiarities. Nonanadromous redband trout are the indigenous trout (Behnke 1979).

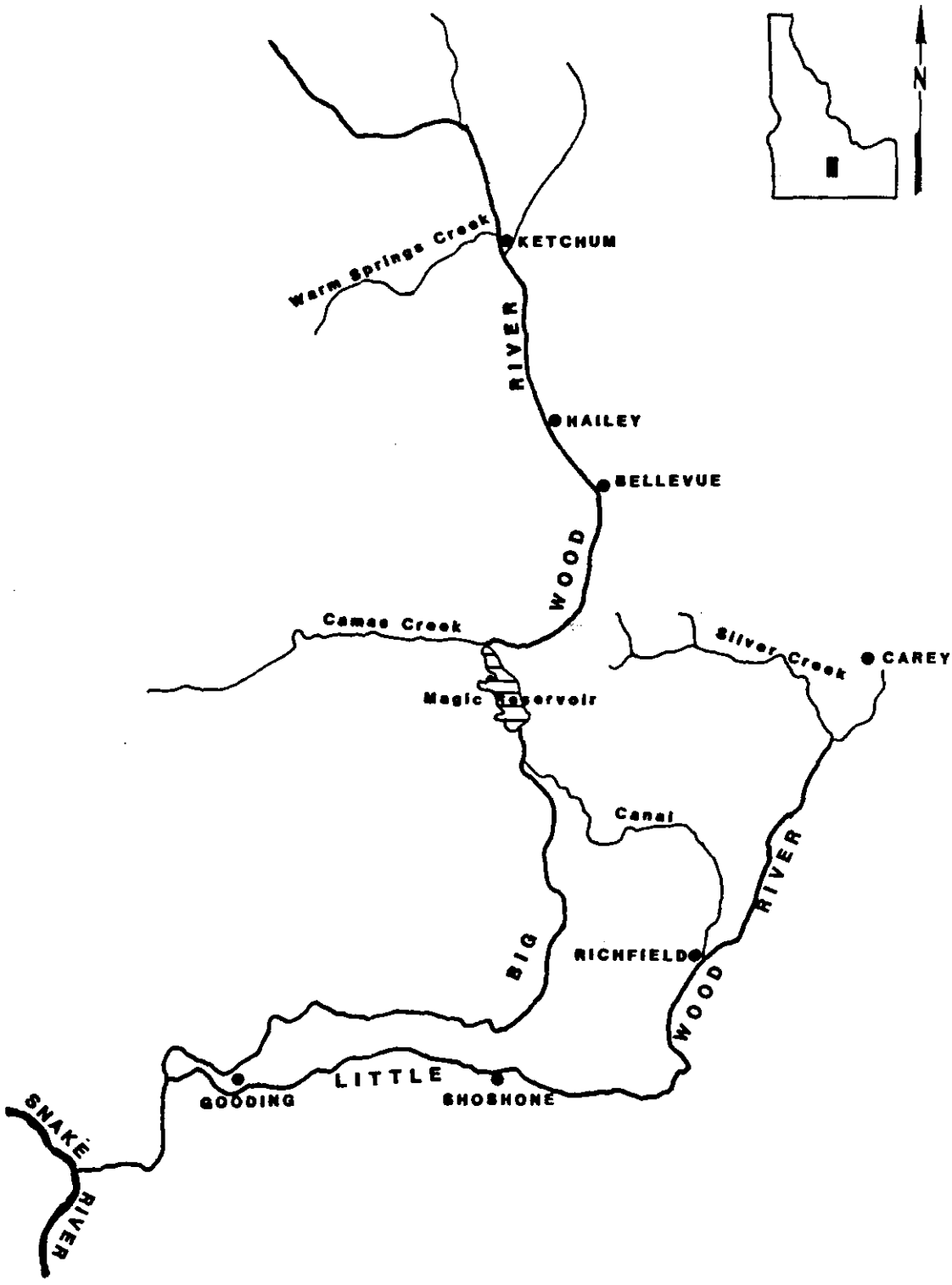

Figure 1. Wood River drainage, Idaho.

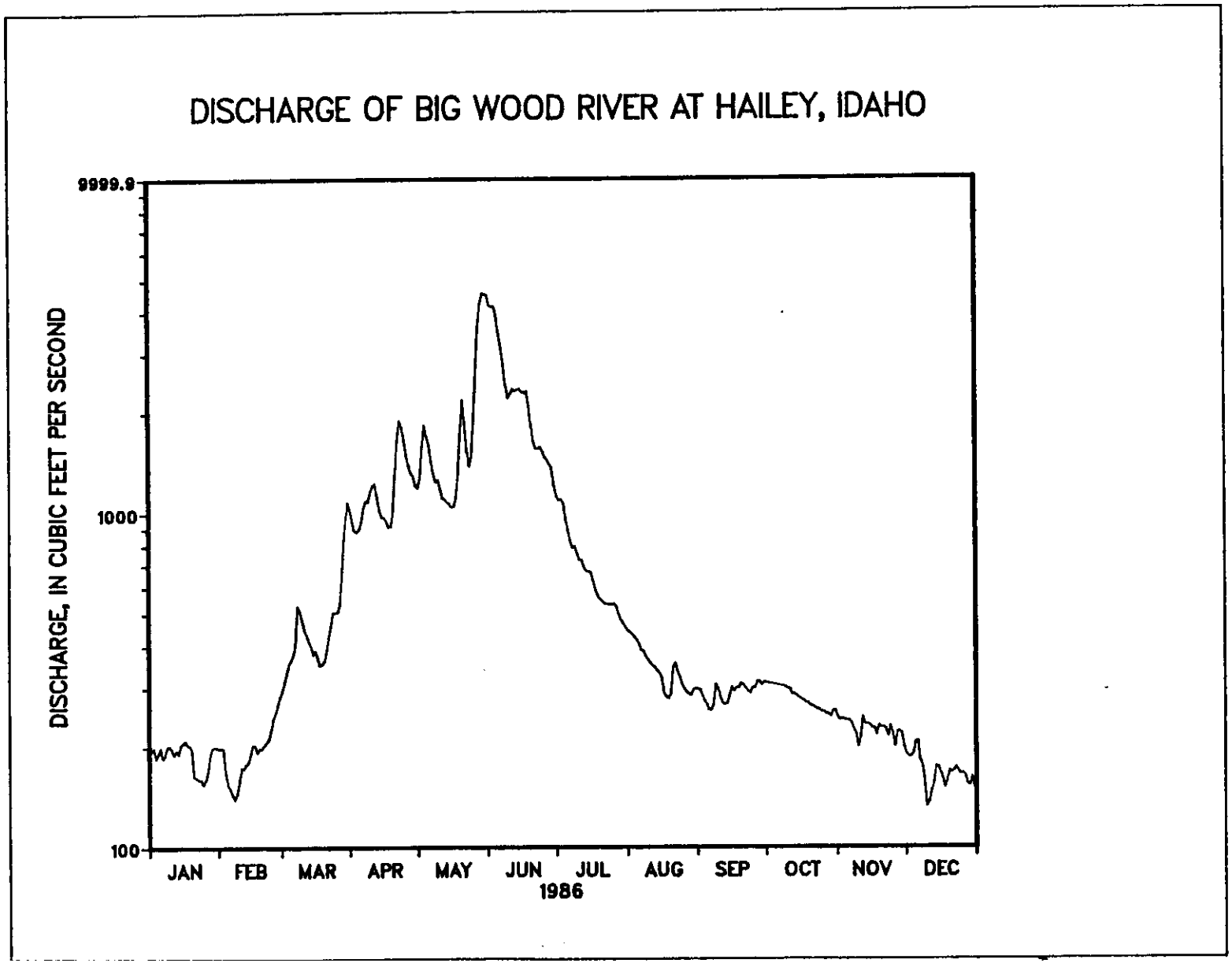

Figure 2. Discharge (cfs) of the Big Wood River at Hailey, Idaho, 1986.

Behnke (1979) describes specimens collected by Evermann in the 1890s with unique morphogical characteristics and suggested that the trout native to the Wood River represents an older, relic form of redband trout. Another species, the Wood River sculpin Cottus leiopomus, is endemic to the Wood River Basin. A third species, the leatherside chub Gila copei, is confined to the Wood River, Bonneville Basin, and the South Fork Snake River.

Native fish fauna are represented by four families composed of Catostomidae, Cottidae, Cyprinidae, and Salmonidae; seven genera; and nine species (Appendix A). Six non-native game fish have been introduced. The most widespread introductions have been of catchable-sized, hatchery-reared rainbow trout. Currently, more than 25,000 are released into the Big Wood River annually from Bellevue upstream to supplement angler harvest of wild rainbow trout.

METHODS

Study Reach Selection

We applied a stream classification system proposed by Rosgen (1985) to stratify the Big Wood River above Magic Reservoir into reaches (Table 1). Delineation criteria included stream gradient and sinuousity (measured from topographic maps and aerial photos), channel entrenchment and valley confinement (estimated from direct observation and topographic maps), soil-landform features (USDA-SCS 1974), and channel width to depth ratio (measured in the field). Stratification was verified in the field by floating each reach. Four different stream types were classified in the Big Wood River between Magic Reservoir and Easley.

Seven electrofishing reaches were delineated on the Big Wood River (Figures 3, 4, and Appendix B). Reaches were randomly selected within each geomorphic stream type. Based on test electrofishing, reaches were a minimum of 1,000 m long to obtain an adequate sample of fish.

Four reaches (3, 4, 5, and 6) were selected in the same stream type (B2) to compare fish populations managed under catch-and-release regulations (Reach 6) with populations under general regulations (reaches 3 to 5) and to correlate cover and habitat components with fish populations in a number of reaches within the same geomorphic type (Figures 3, 4, and Table 1). Two additional reaches were selected on the Little Wood River.

Trout Population Dynamics

Mark-recapture electrofishing surveys were completed in reaches during the spring (April to May), summer (July to August) and fall (October to November). Where feasible, we used an aluminum canoe as the cathode and waded upstream through the reach with two mobile anodes. In the remaining

Table 1. Big Wood River geomorphic stream classification.

Reach location	Stream type[a]	Gradient (%)	Sinuosity[a]	Mean width-depth ratio	Dominant particle size of materials	Channel entrenchment valley confinement	Landform feature soils/stability[b]
Magic Reservoir to Glendale Diversion	C3	0.5-1.0(0.6)	1.2-1.5	22	Gravel bed with mixture of cobble and sand	Moderately entrenched; slightly confined	Low, alluvial terraces; gravelly, sandy loam
Glendale to Star Bridge	C3	0.5-1.0(0.6)	1.2-1.5	22	Gravel bed with mixture of cobble and sand	Moderately entrenched; slightly confined	Low, alluvial terraces; gravelly, sandy loam
Star Bridge to Deer Cr. Bridge	B3	0.5-1.0(0.6)	1.0-1.2	22	Cobble bed with mixture coarse gravel	Moderately entrenched; well confined along west hillside	Rock outcrop, highly erosive on west side remainder terraces
Deer Creek to Red Top	B2	0.5-1.0(0.8)	1.2-1.5	20	Cobble bed with mixture of coarse gravel	Moderately entrenched; moderately confined	Alluvial fans and terraces gravelly, sandy loam
Red Top to Warm Springs	B3	0.5-1.0(0.7)	1.0-1.2	No data	Cobble bed with mixture of coarse gravel	Moderately entrenched; well confined along west hillside	Ground loam and bed rock, terraces and mountain slopes
Warm Springs to North Fork	B2	1-1.5(1.2)	1.0-1.2	19	Cobble bed with mixture of boulders and course	Moderately entrenched; moderately confined	Alluvial fans, gravelly, sandy loam
North Fork to Easley	B1	0.5-1.0(0.9)	1.2-1.5	18	Cobble bed with mixture of coarse boulders and coarse gravel	Moderately entrenched; well confined along west hillside	Gravel loam and bed rock terraces and mountain slopes

[a]Source: Rosgen (1985).
[b]Source: USDA-SCS (1974).

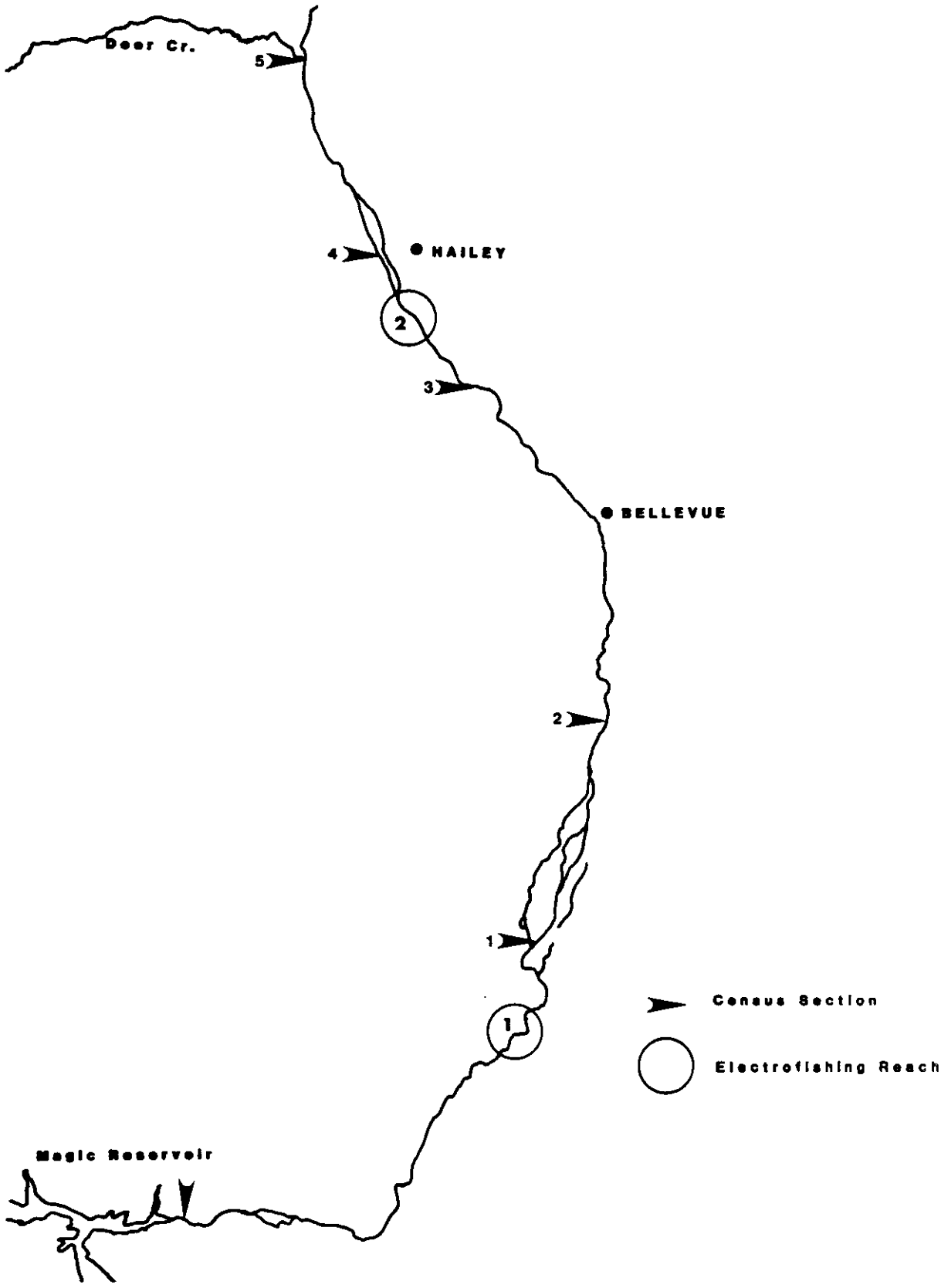

Figure 3. Map of Big Wood River electrofishing reaches and creel census sections (Magic Reservoir to Deer Creek).

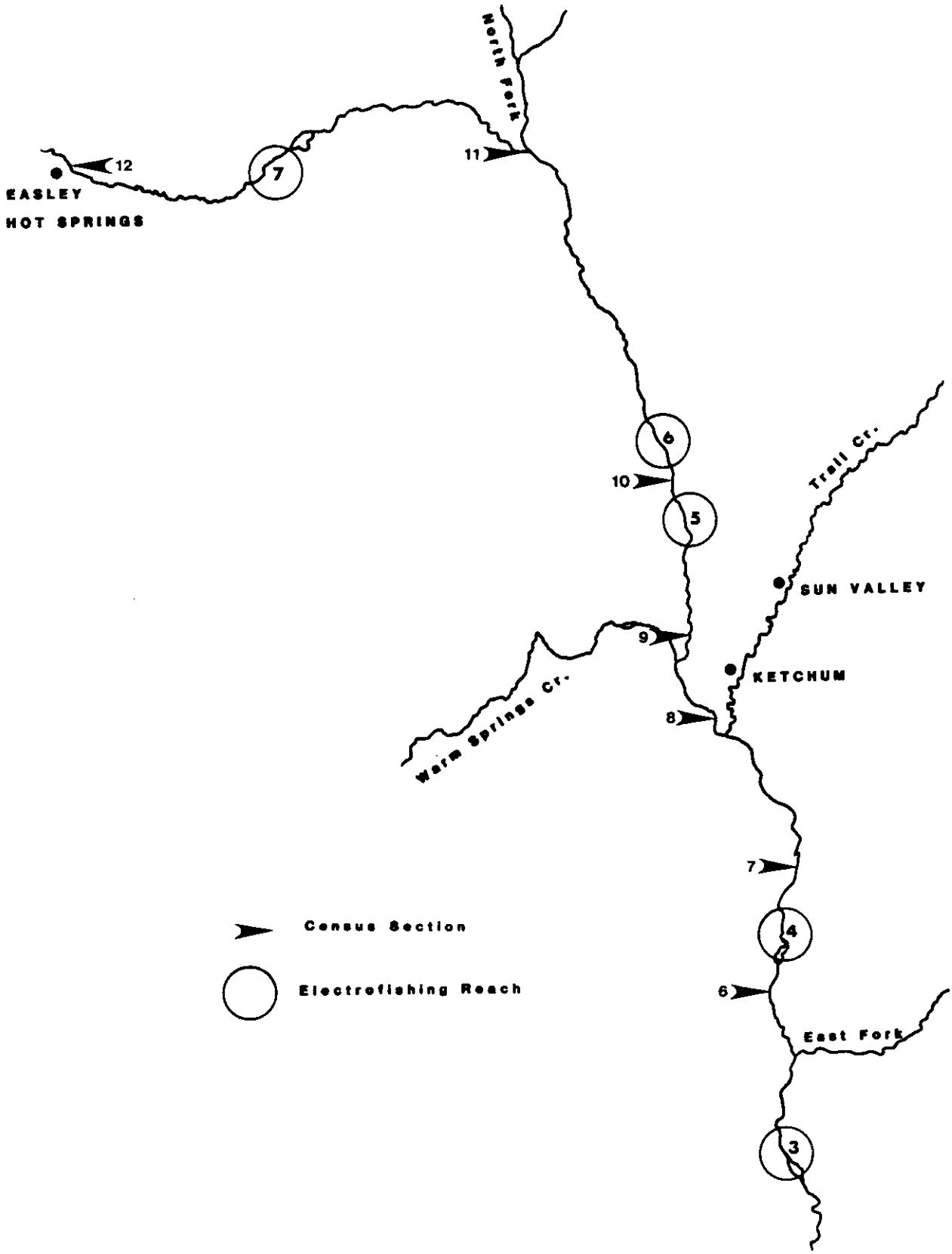

Figure 4. Map of Big Wood River electrofishing reaches and creel census sections (upstream from Deer Creek). Section 11 includes the entire catch-andrelease area; all other sections managed under general regulations.

reaches, we used an aluminum Mackenzie river boat as the cathode and floated downstream with a single mobile anode. All captured trout were measured (total length) by species, weighed, and given a temporary fin clip. Scales were collected below the adipose fin and above the lateral line from 10 to 20 trout in each 50 mm length group. All captured trout were released into the reach at the conclusion of the marking runs.

A modification of the Peterson single mark-and-recapture formula and the Schnabel multiple mark-and-recapture formula was used to estimate the population of trout (>100 mm) in each reach (Ricker 1975). Estimates were apportioned to 50 mm size groups based on their incidence captured. We plotted the relationship between length and weight. The length-weight relationship was applied to the length-frequency distribution to estimate trout biomass in each reach.

Total instantaneous mortality (Z) and total annual mortality (A) were estimated from catch curves based on age classes as described by Lackey and Hubert (1978) and Ricker (1975). Catch curves were constructed for trout sampled by electrofishing. Exploitation rates were quotients of harvest (estimated by creel census) and population size (estimated by electrofishing).

Movements

To evaluate seasonal movements between study reaches, we differentially fin clipped trout in each study reach. Trout larger than 250 mm were permanently tagged with individually numbered Floy tags.

All recaptured trout (fin clips or tags) were measured, weighed, and released during subsequent electrofishing surveys. We solicited angler tag returns by news releases, posting of informational signs, and placing tag deposit boxes in local establishments.

Age and Growth

Impressions of rainbow and brown trout Salmo trutta scales were made on acetate slides using a lab press with heated plates. Scales were read on a microprojector with a 6.5 mm lens. We recorded the total number of annuli and measured the distance from the focus center to each annuli along the median anterior radius. A computer statistical package was used to pair fish total length and anterior scale radius (ASR). Several regression models were examined, including exponential, logarithmic, linear, and second- and third-degree polynomials. The line that best fit the data was determined from r^2 values. Lengths were back-calculated using mean distances to each annulus for each age class to determine growth increments. Fish from different reaches were compared for growth differences and tested statistically.

Creel Census

Geomorphic stream type, angling regulations, and fishing access were used to divide the Big Wood River into 12 segments for the creel census (Figures 3 and 4). Eight sections were incorporated into the 1986 census (3, 4, 6 to 8, and 10 to 12). Two additional sections were censused on the Little Wood River.

A stratified angler-count census was used to estimate effort and harvest. The census was stratified by 14-day intervals and day type (weekday, weekend, and holiday). During each interval, we randomly selected two weekdays, two weekend days, and all holidays for counts. Three counts were made during each day and count times were randomly selected between sunrise and sunset. Total angler hours for each interval was estimated by multiplying the mean angler count per day type for the interval, and the mean day length for the interval, and summing estimates for each day type. Total estimated harvest for each interval was calculated as the total angler hours for the interval multiplied by the mean harvest rate for each fish species during the interval. A complete description of the equations used, and calculation of variance and confidence intervals, is included in Rieman (1983). The computer program SUMMARY was used to make the calculations.

Evaluation of Special Regulations

Fish population data collected by electrofishing and creel census data were compared between stream reaches with catch-and-release and general fishing regulations. Stream reaches that shared as many similarities as possible (geomorphic type, discharge, habitat quality, access, stocking history, etc.) were selected for the evaluation.

Movements of marked fish between special regulation and general regulation stream reaches were closely monitored.

Correlating Habitat and Fish Populations

Two methods were applied to evaluate the importance of various habitat types and cover components to fish populations. First, we mapped habitat types and cover components within each electrofishing reach. Quantified habitat and cover data were correlated with fish population data collected within respective reaches.

Each electrofishing reach was surveyed on foot. Using a rangefinder and tape, we established transects at 100 m intervals proceeding upstream. At each transect, we collected the following data: channel width, maximum depth, streambank stability rating (stable, cutting, depositioned, or riprapped), streambank vegetative stability (Platts et al. 1983), and substrate components. Simultaneously, we identified different habitat types (riffles, pools, glides, etc.) using the definitions proposed by Sisson et al. (1982). The length and average width of each habitat were

measured to enable surface area estimation. The lengths and areas of each habitat type were summed for each reach and expressed as a percentage of the total.

Proceeding downstream, we recorded cover components (woody debris, undercuts, vegetative overhang, partially exposed boulders, etc.). The length and average width of each cover component were measured to estimate area. The areas of each cover component were also summed for each reach and expressed as a percentage of the total.

Second, we conducted snorkel surveys of fish associated with various habitat components in reaches 1 to 4 and 6 of the Big Wood River. Snorkel locations were systematically selected proceeding upstream at each location. A test site containing habitat components (woody debris, undercuts, vegetative overhang, etc.) and a control site (identical habitat type without cover components) were paired. Sites containing riprap were also surveyed.

All salmonids were counted by 100 mm size groups at each site. Following each count, we classified habitat and cover components and measured the surface area of stream counted.

Irrigation Diversion Surveys

Meetings were held with the local water master to obtain maps of all significant irrigation diversions on the Big Wood River above Magic Reservoir. We obtained data on the quantity of water withdrawn, duration and timing of withdrawal, and management of the ditches after the irrigation season.

Several ditches and diversions were located via ground and aerial reconnaisance. No ditches were electrofished in 1986. Data from historical irrigation surveys were compiled from regional files.

On July 16, a gravel berm was bulldozed across the Big Wood River at the Glendale Diversion near Bellevue. The river channel gradually dewatered and fish were stranded in pools downstream. On July 17, a crew of local anglers, fishing guides, and IDFG employees salvaged fish from the site. We used a canoe and two mobile anodes to electrofish the river channel, starting immediately downstream from the Glendale Bridge to the diversion berm. We also used a backpack shocker to salvage several small pools within 3 km downstream of the berm.

All salvaged salmonids were measured and received an adipose fin clip for identification. Salvaged fish were reintroduced in the Big Wood River between Hailey and Ketchum.

Redd Counts

We conducted redd counts to monitor the brown trout population in the Big Wood River. On November 17, I walked the Big Wood River downstream from the Glendale Diversion confluence to Stanton Crossing Highway Bridge. Visibility was *very* good and most redds were recent and distinguishable by the cleaned gravel in both the depression and downstream mound. Some older redds were more difficult to distinguish, although the depressions and gravel mounds were visible. I did not count all side channels but covered the major ones.

On November 19, we completed a helicopter redd count in the same reach. All side channels were surveyed. We also counted redds from Stanton Crossing Highway Bridge downstream to Sheep Bridge.

RESULTS

Trout Populations

Species Composition

Wild rainbow trout comprised a majority of the salmonids captured in the Big Wood River in 1986. **Eighty-four** percent of the 2,215 salmonids captured by electrofishing were wild rainbow trout (Table 2).

The incidence of game fish species varied with season and stream reach. The proportion of wild rainbow trout ranged from 53% to 99% by season and reach (Table 2). Hatchery-reared rainbow trout were the second most abundant species captured (N-305, or 12% of total). Hatchery-reared rainbow trout ranged from 2% in Reach 1 to 41% in Reach 6. The large abundance of hatchery rainbow trout in Reach 6 was due to upstream straying of fish stocked from the Hulen Meadows Bridge. We captured 15 hatchery rainbow trout in April 1986 that were holdovers from 1985 stocking.

Brook trout Salvelinus fontinalis were present in all seven reaches and most abundant in reaches 2 and 6 (Table 2). We captured brown trout in Reach 1 only. The proportion of brown trout increased in fall as mature fish migrated upstream from Magic Reservoir to spawn (see Movements). We captured three cutthroat trout that may have migrated from mountain lakes in the Big Wood River drainage. Mountain whitefish Prosopium williamsoni were captured in all reaches and were most abundant in reaches 2 through 7.

Abundance

We completed mark-recapture population estimates (fish >100 mm) in seven reaches of the Big Wood River (Appendix C). Spring estimates were made in four reaches, summer estimates in seven reaches, and fall estimates in four reaches. Spring estimates were difficult due to large stream

Table 2. Species composition and numbers of salmonids captured by electrofishing in the Big Wood River, 1986.

Reach	Season	Wild rainbow trout	Hatchery rainbow trout	Brook trout	Brown trout	Cutthroat trout	Total	% Wild rainbow trout
1	Spring	79	8	0	2	0	89	89
	Summer	426	1	6	7	0	440	97
	Fall	285	4	3	42	1	335	85
	Total	790	13	9	51	1	864	91
2	Spring	94	6	8	0	0	108	87
	Summer	285	21	17	0	0	323	88
	Total	379	27	25	0	0	431	88
3	Spring	38	5	0	0	0	43	88
	Summer	170	2	0	0	0	172	99
	Fall	73	2	1	0	0	76	96
	Total	281	9	1	0	0	291	97
4	Spring	47	11	0	0	0	58	81
	Summer	198	27	2	0	0	227	87
	Fall	185	11	1	0	0	197	94
	Total	430	49	3	0	0	482	89
5	Summer	90	54	4	0	0	148	61
6	Summer	103	70	14	0	1	188	55
	Fall	81	70	2	0	0	153	53
	Total	184	140	16	0	1	341	54
7	Summer	61	13	6	0	1	81	75
Grand total		2,215	305	64	51	3	2,638	
		84%	12%	2%	2%	0.1%		

Legend: Spring = April and May
Summer = July and August
Fall = October and November

discharge and turbid water conditions. Spring-spawning rainbow trout migrated considerable distances (see Movements); therefore, spring estimates were not reliable estimators of abundance.

Population estimates varied considerably among reaches and with season (Table 3). Summer densities of wild rainbow trout ranged from 156 to 1,068 trout/km and from 126 to 593 trout/hectare. Reaches 1, 2, and 3 maintained the largest summer densities of wild rainbow trout. Densities of wild rainbow trout decreased from summer to fall in reaches 1, 3, and 4. Densities increased from summer and fall in Reach 6.

Biomass of wild rainbow trout ranged from 11.4 to 245 kg/km and from 8.9 to 119.7 kg/hectare (Table 3). Reaches 2, 3, and 4 supported the largest summer biomass of trout. Reach 6 supported the largest fall biomass of trout.

Summer densities of trout in the Big Wood River exceed those found in sections of the Big Lost and Portneuf rivers, and Silver Creek (Table 4).

Sizes

Wild rainbow trout captured by electrofishing ranged from 40 to 660 mm (Figure 5). Reach 1 and reaches 2 to 7 are displayed separately due to the greater growth rate of fish in Reach 1 due to the influence of Magic Reservoir (See Age and Growth).

Size of trout varied among reaches and by season (Table 5 and Figures 6 and 7). During spring surveys, we captured a large proportion of mature spawners and few juvenile fish. The proportion of fish exceeding 300 and 400 mm ranged from 36 to 64% and 5 to 19%, respectively. Age classes were more normally distributed during summer surveys. The mean length of trout during summer ranged from 175 to 243 mm. We captured very few young-of-the-year (<100 mm) because most had not yet emerged from redds. In fall, we sampled all age classes, including young-of-the-year. We also captured more fish larger than 200 mm and 300 mm in the fall than during summer. The increase in mean size was probably a result of growth attained between summer and fall.

During summer surveys, reaches 1, 2, and 7 supported the largest proportion of juvenile trout (<200 mm) (Table 5). Reaches 3, 4, and 6 supported the largest proportion of trout exceeding 300 and 400 mm (24 to 25% and 4 to 9%, respectively). In fall, Reach 1 supported the largest proportion of juvenile trout. Reach 3 supported the largest proportion of trout exceeding 300 and 400 mm (44% and 10%, respectively).

We collected wild rainbow trout that weighed up to 2.8 kg. Length-weight equations for wild rainbow trout from reaches 1 to 7 are shown in Table 6. Length-weight relationships were similar for all sections (Figure 8).

Table 3. Estimated trout populations and densities in electrofished reaches of the Big Wood River, 1986.

		All trout				Wild rainbow trout					
			95%				95%				
		Population	confidence	Density		Population	confidence	Density		Biomass	
Reach	Season	estimate	interval	#/km	#/ha	estimate	interval	#/km	#/ha	kg/km	kg/ha
1	Spring	472	(265-2,142)	255	--	420	(236-1,906)	227	--	11.39	8.91
	Summer	1,444	(1,139-1,971)	781	61.1	1,400	(1,105-1,912)	758	59.3	85.52	67.0
	Fall	505	(379-756)	273	21.4	429	(322-642)	232	18.2	26.90	21.06
2	Spring	1,063	(565-9,083)	532	--	925	(492-7,902)	463	--	138.35	75.89
	Summer	1,839	(1,297-3,160)	920	50.4	1,618	(1,141-2,780)	810	44.4	167.24	91.67
3	Summer	1,151	(696-3,320)	1,079	52.7	1,139	(689-3,286)	1,068	52.1	245.00	119.66
	Fall	184	(109-600)	173	8.4	177	(105-576)	166	8.1	50.19	29.51
4	Summer	1,187	(796-2,326)	600	34.7	1,032	(693-2,024)	522	30.1	124.51	71.95
	Fall	777	(533-1,430)	393	22.7	730	(501-1,344)	369	21.3	101.11	58.43
5	Summer	679	(447-1,411)	574	38.1	414	(273-861)	350	23.3	50.33	33.44
6	Summer	498	(371-755)	433	28.7	274	(204-415)	238	15.8	66.28	43.92
	Fall	818	(645-1,120)	712	47.2	434	(342-594)	377	25.0	94.16	62.39
7	Summer	225	(150-450)	208	16.8	169	(112-338)	156	12.6	19.32	15.57

Table 4. Densities of wild rainbow trout from selected Idaho waters.

Location	Season	Trout/km		Trout/hectare		Sizes	Source
		Range	Mean	Range	Mean	(mm)	
Big Wood River	Summer	156-1,068	587	129-593	367	>100	current study
	Fall	166-377	293	81-250	182	>100	current study
Big Lost River							
East Fork 1	Summer	--	226	--	164	>80	Elle and Corsi (1987)
East Fork 2	Summer	--	111	--	95	>80	Elle and Corsi (1987)
North Fork	Summer	--	274	--	265	>80	Elle and Corsi (1987)
Henrys Fork Snake R.							
Box Canyon	May	--	2,898	--	438	>80	(C. Corsi, IDFG, personal communication)
Harriman	June	--	3,645	--	609	>175	(C. Corsi, IDFG, personal communication)
Portneuf River							
1978-1986	Fall	61-232	170	--	--	>90	Heimer and Schill (1987)
Silver Creek							
Catch-and-release	Summer	960-1,165	1,085	259-316	276	>100	Parker et al. (1986)
General regulations	Summer	358-1,116	561	181-385	274	>100	Parker et al. (1986)

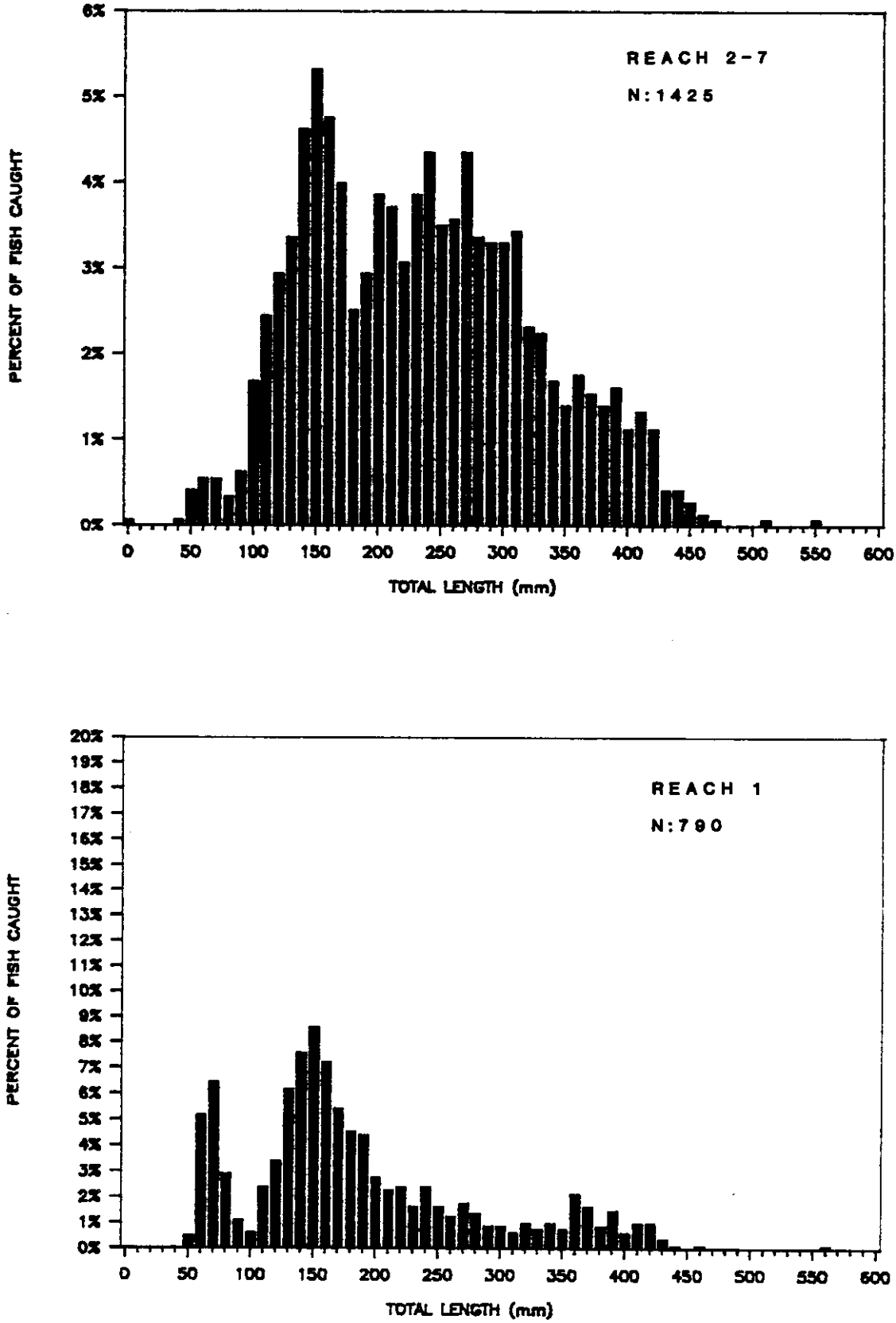

Figure 5. Length frequencies of wild rainbow trout captured by electrofishing in Reach 1 and reaches 2 to 7, Big Wood River, 1986.

Table 5. Length statistics for wild rainbow trout in the Big Wood River, 1986.

Reach	Season	N	Mean total length (mm)	Standard deviation	≤200 mm #	≤200 mm (%)	≥300 mm #	≥300 mm (%)	≥400 mm #	≥400 mm (%)
1	Spring	79	323	99	12	(15)	51	(65)	15	(19)
	Summer	426	175	67	323	(76)	32	(8)	7	(2)
	Fall	285	152	98	214	(75)	34	(12)	6	(2)
	Total	790	182	96	549	(69)	117	(15)	28	(4)
2	Spring	94	281	87	18	(20)	46	(49)	10	(11)
	Summer	285	202	78	172	(60)	45	(16)	9	(3)
	Total	379	220	88	190	(50)	91	(24)	19	(5)
3	Spring	38	257	81	10	(26)	14	(37)	2	(5)
	Summer	170	232	82	61	(36)	42	(25)	6	(4)
	Fall	73	235	123	33	(45)	32	(44)	7	(10)
	Total	281	236	95	104	(37)	88	(31)	15	(5)
4	Spring	47	282	77	8	(17)	17	(36)	4	(9)
	Summer	198	236	81	70	(35)	46	(23)	11	(6)
	Fall	185	250	83	55	(30)	63	(34)	8	(4)
	Total	430	247	83	133	(31)	126	(29)	23	(5)
5	Summer	90	192	72	48	(53)	5	(6)	2	(2)
6	Summer	103	243	94	37	(36)	32	(31)	6	(6)
	Fall	81	220	110	37	(46)	20	(25)	7	(9)
	Total	184	233	102	74	(40)	52	(28)	13	(7)
7	Summer	61	186	64	37	(61)	5	(8)	0	(0)
2-7	Spring	179	275	86	37	(21)	77	(43)	16	(9)
	Summer	907	218	82	426	(47)	175	(19)	34	(4)
	Fall	339	240	101	125	(37)	115	(34)	22	(6)
	Total	1,425	230	90	587	(41)	367	(26)	72	(5)

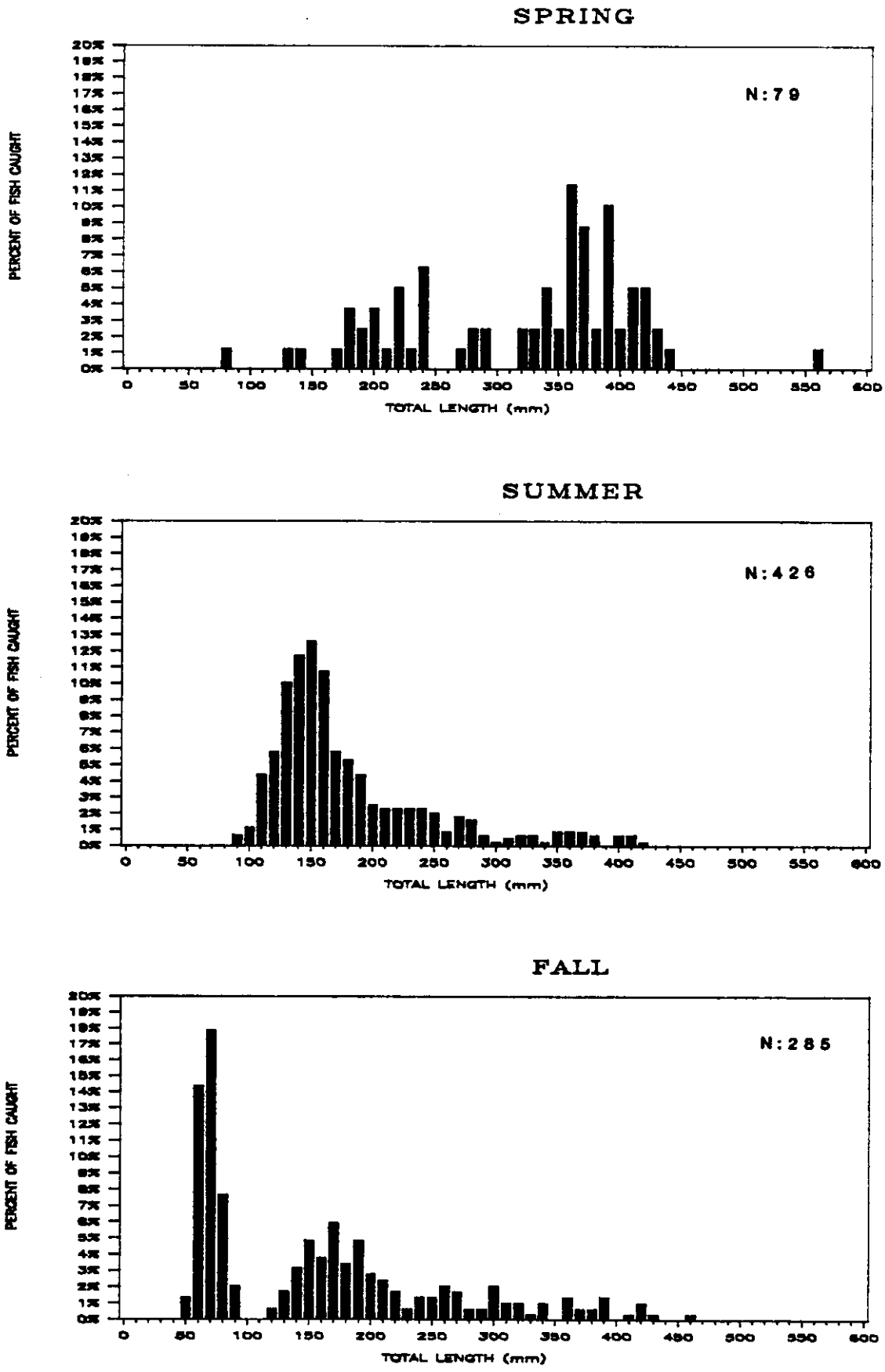

Figure 6. Length frequencies of wild rainbow trout captured by electrofishing in Reach 1 during spring, summer, and fall surveys, Big Wood River, 1986.

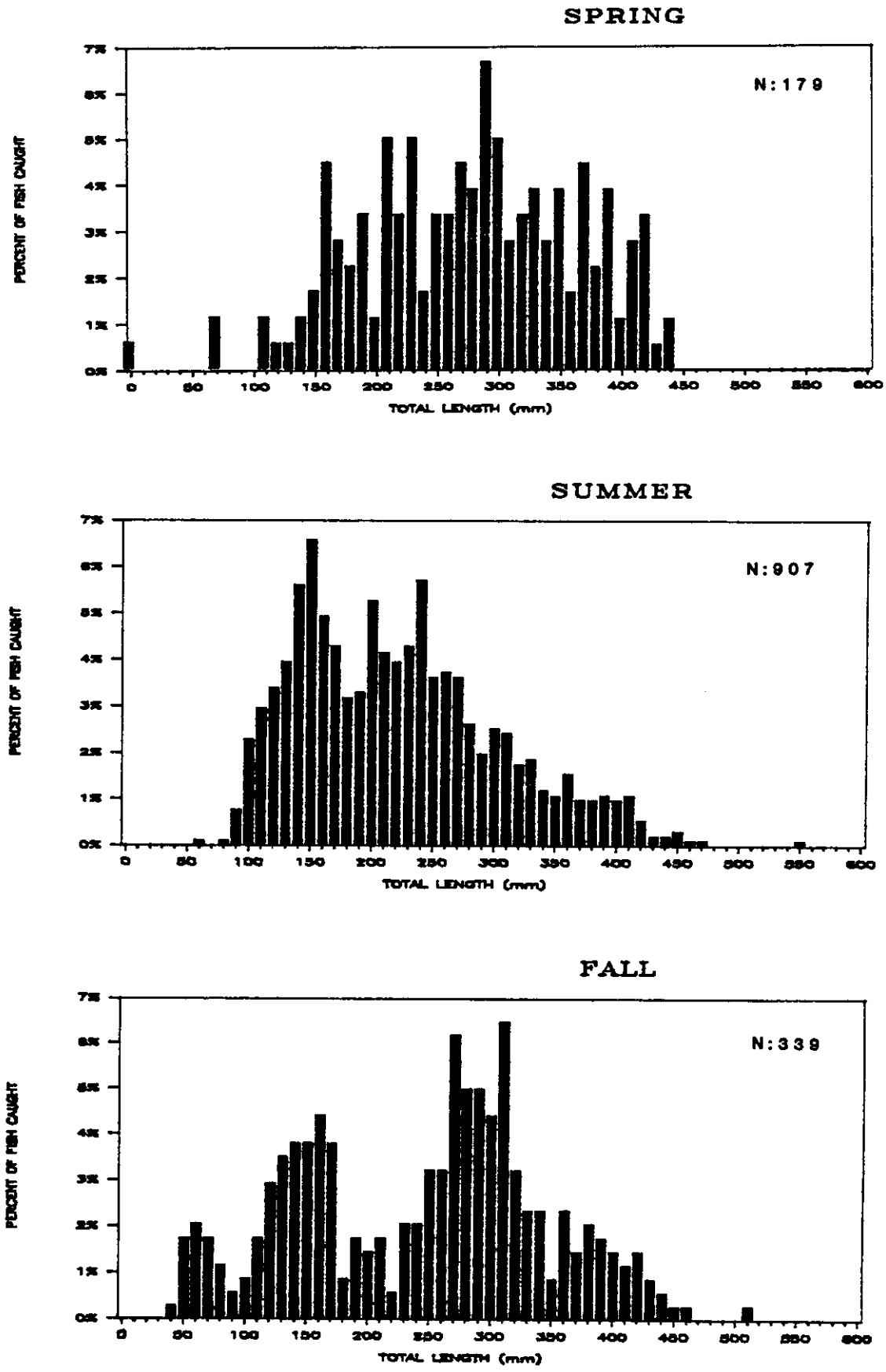

Figure 7. Length frequencies of wild rainbow trout captured by electrofishing in reaches 2 to 7 during spring, summer, and fall surveys, 1986.

Table 6. Length-weight relationships for wild rainbow trout in the Big Wood River, 1986.

Section	Sample size	Coefficient of determination (r^2)	a		b	
			Value	Std. error	Value	Std. error
1	677	0.98	1.2699×10^{-5}	1.078	2.958	0.014
2	343	0.99	9.5306×10^{-6}	1.112	3.011	0.020
3	258	0.98	1.0222×10^{-5}	1.140	3.001	0.024
4	411	0.99	1.0778×10^{-5}	1.103	2.993	0.018
5	87	0.98	7.6332×10^{-6}	1.250	3.060	0.043
6	174	0.98	8.8243×10^{-6}	1.226	3.025	0.038
7	59	0.99	9.4547×10^{-6}	1.270	3.023	0.046
2-7	1,332	0.98	9.801×10^{-5}	1.060	3.009	0.011

Equation:

$W = aL^b$

Where:

W = weight (g), and

L = total length (mm).

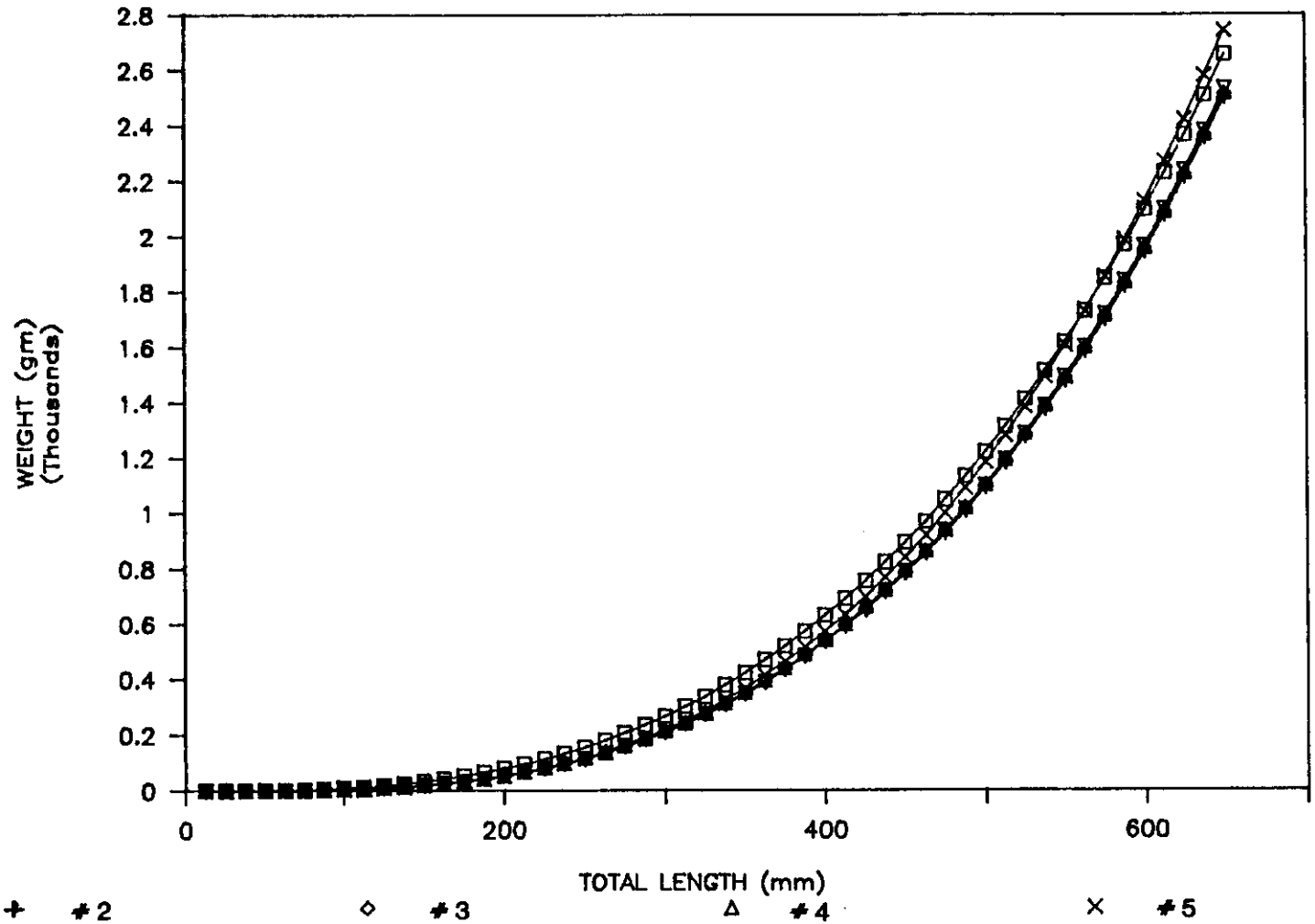

Figure 8. Length-weight relationship for wild rainbow trout captured by electrofishing in reaches 1 to 6, Big Wood River, 1986.

Sixty-six brook trout, captured by electrofishing, ranged from 60 to 390 mm (Figure 9). Brook trout averaged 191 mm and few exceeded 250 mm. The length-weight relationship for 63 brook trout was defined by the regression equation W-aL^{b} where W-weight (g), a-1.5479 x 10-^{5} with standard error 1.388, L-total length (mm) and b-2.912 with standard error .063.

We captured 51 brown trout in Reach 1 that ranged from 120 to 620 mm (Figure 10). Eighty-two percent of the brown trout were mature fish captured in the fall. Brown trout averaged 388 mm, 71% exceeded 300 mm, 53% exceeded 400 mm, and 22% exceeded 500 mm. The length-weight relationship for 46 brown trout was described by the regression equation W-aL^{b} where W-weight (g), a=1.0001 x 10-^{5} with standard error 1.388, L-total length (mm), and b-3. 004 with standard error .036. The length-weight relationship for brown trout in the Big Wood River was similar to that for brown trout in two reaches of the Little Wood River (Figure 11). Five hundred and fifty-three mountain whitefish captured by electrofishing ranged from 70 to 480 mm total length (Figure 12) and averaged 258 mm. Five possible age classes are evident in the length-frequency. We did not weigh whitefish.

Age And Growth

Scales were collected and analyzed from 115 and 111 wild rainbow trout in reaches 1 and 4, respectively. Fish ranged from 47 to 667 mm total length and encompassed age groups 0 through 5. We encountered extensive variability in age of similar-sized fish. Many scales also exhibited evidence of absorption and regrowth with checks.

The body length to anterior scale radius (ASR) relationship was similar for fish from both reaches. However, due to the potential influence of Magic Reservoir on fish in Reach 1, growth models were calculated independently. These relationships were best described by the logarithmic regression: total length-3.86 x ASR$^{O.982}$ (Reach 1) and total length-4.47 x ASR°-^{952} (Reach 4) (Appendices D and E).

Rainbow trout grew to average lengths of 84, 173, 288, 392, and 550 mm long at ages 1 through 5 in Reach 1 and 100, 176, 279, 358, and 461 mm long at ages 1 through 5 in Reach 4 (Table 7). Lengths at age 5 were based on sample sizes of one and two fish, respectively, so these values may not be representative. It also appears that Lee's Phenomenon affected lengths back-calculated to age 1. Lee's Phenomenon occurs when the back-calculated size of younger-aged fish is underestimated from scales of older fish (Ricker 1975). This occurs when the body-scale relationships are inconsistent, or by selective mortality on the fastest growing trout.

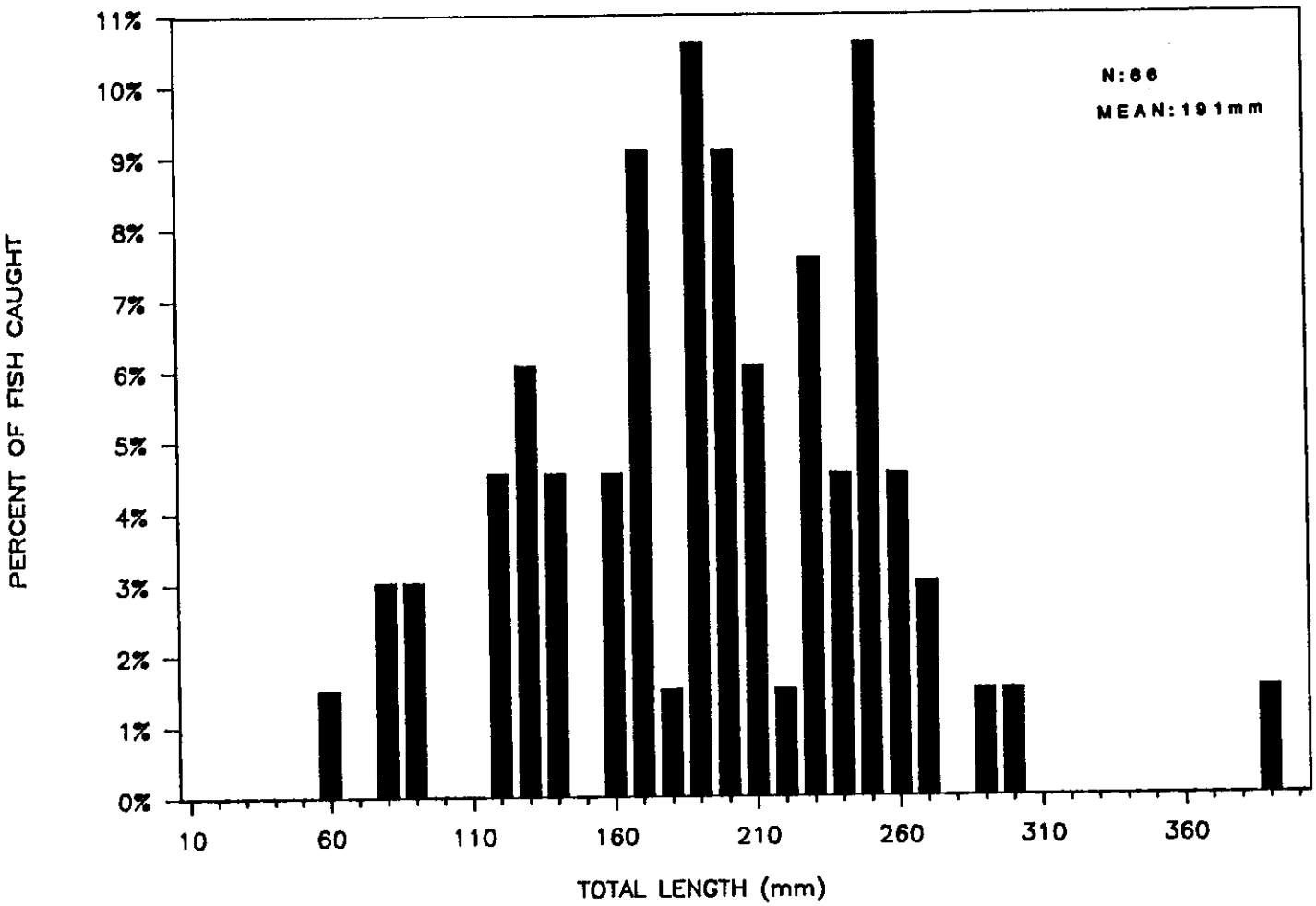

Figure 9. Length frequencies of brook trout captured by electrofishing in reaches 1 to 7, Big Wood River, 1986.

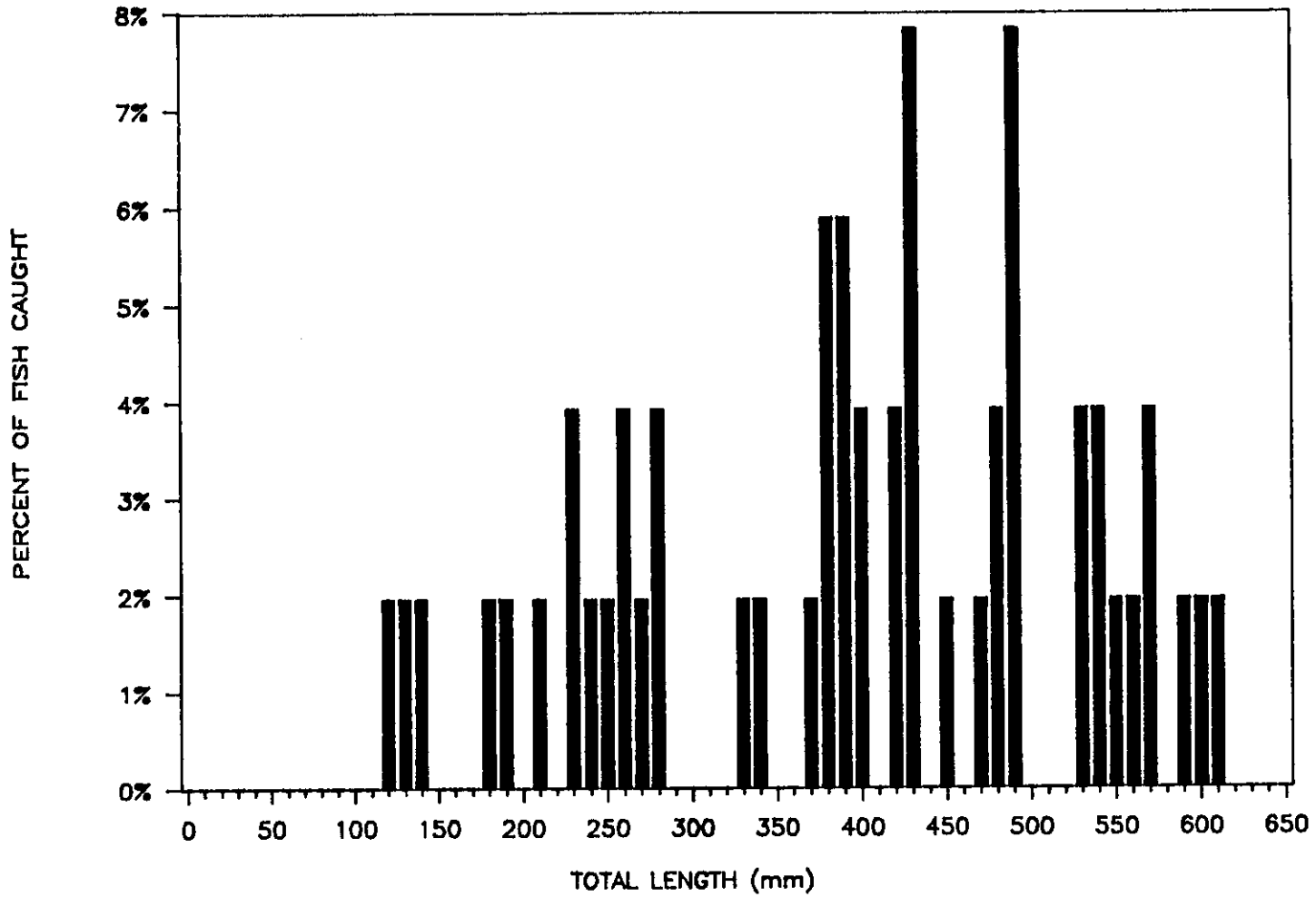

Figure 10. Length frequencies of brown trout captured by electrofishing in Reach 1, Big Wood River, 1986.

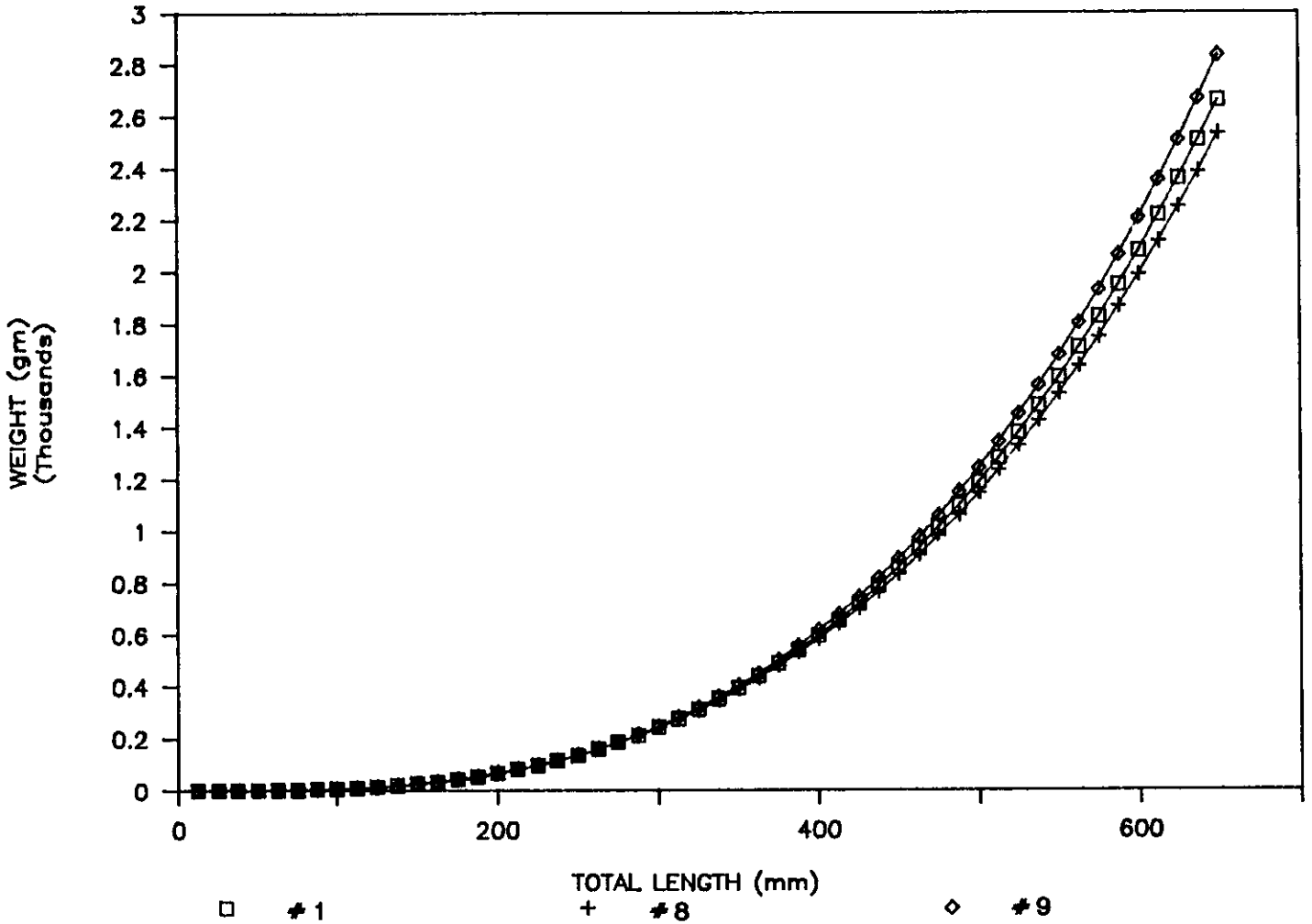

Figure 11. Length-weight relationship for brown trout captured by electrofishing in Reach 1, Big Wood River and reaches 8 and 9, Little Wood River, 1986.

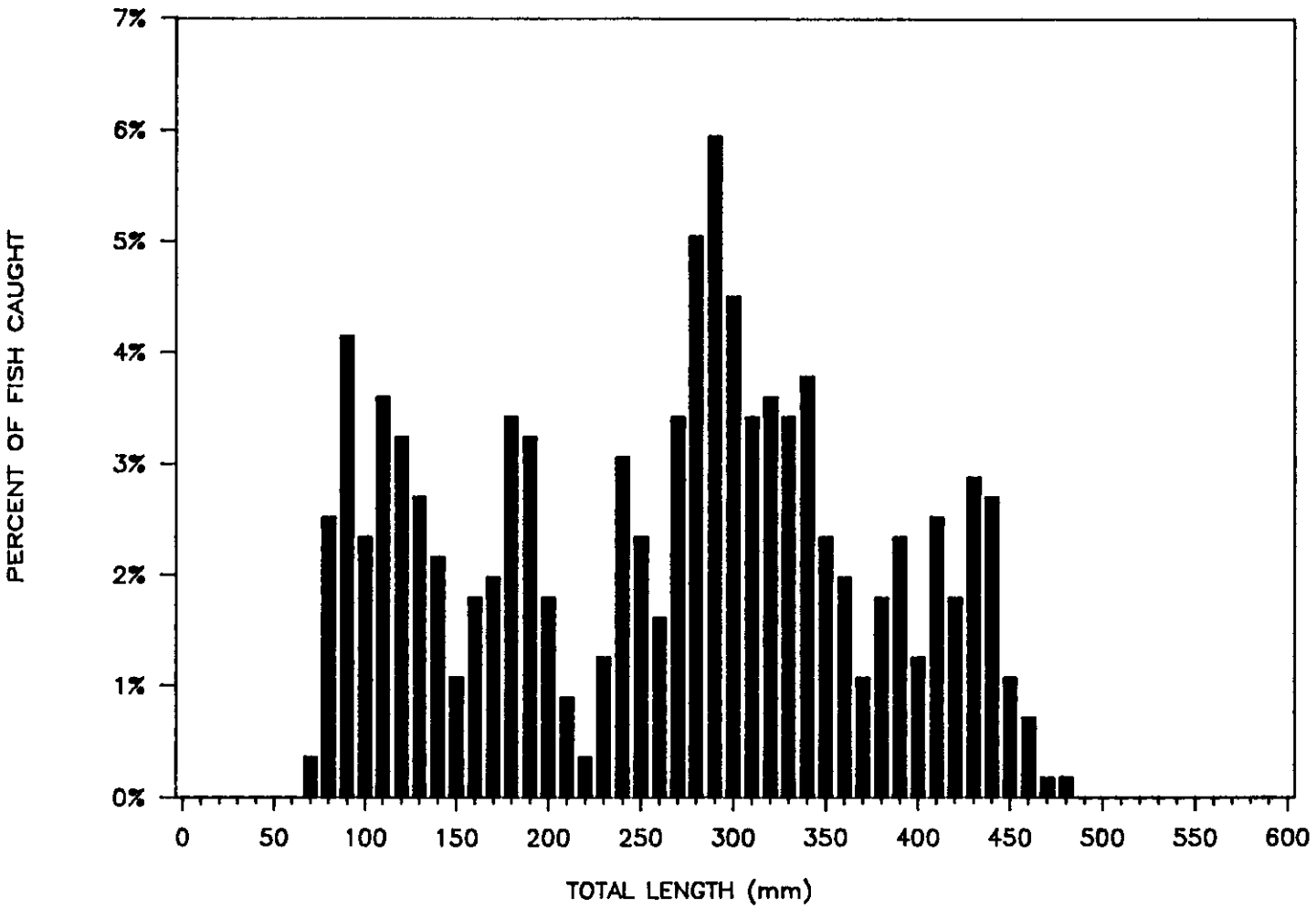

Figure 12. Length frequencies of mountain whitefish captured by electrofishing in reaches 1 to 7, Big Wood River, 1986.

Table 7. Mean calculated total lengths and increments of growth for wild rainbow trout in the Big Wood River, 1986.

Age class	No. fish	Calculated total length at each annulus (mm) 1	2	3	4	5	Mean length at capture
				Reach 1			
0	30						88
I	31	92					172
II	52	82	173				287
III	25	75	164	286			370
IV	6	85	193	282	380		451
V	1	104	240	383	460	550	667
No. fish		115	84	32	7	1	
Wt. grand avg.		84	173	288	392	550	
Mean growth inc.		84	89	115	104	158	
				Reach 4			
0	13						102
I	28	113					166
II	47	96	174				266
III	22	95	182	290			353
IV	12	96	172	257	353		423
V	2	107	178	295	388	461	478
No. fish		111	83	36	14	2	
Wt. grand avg.		100	176	280	358	461	
Mean growth inc.		100	76	103	79	103	

Wild rainbow trout in the Big Wood River exhibit a relatively rapid rate of growth. When compared to wild rainbow trout from other Idaho rivers, Big Wood River trout had growth rates comparable to those observed in Silver Creek, the South Fork Boise River, and sections of the Henrys Fork Snake River (Table 8). Wild rainbow trout in the Big Wood River have sufficient growth potential and longevity to attain a large site. A plot of length-at-age for trout from reaches 1 and 4 illustrates the growth potential for older-aged trout (Figure 13). The plot also exhibits the enhanced growth rates after age 3 in Reach 1. This enhanced growth is likely a result of trout spending a portion of their life cycle in the productive waters of Magic Reservoir.

Movements

Wild **Rainbow** Trout

Returns of wild rainbow trout tagged, or fin-clipped, and released in the Big Wood River indicate that **a** portion of the population exhibits seasonal movements. Trout tagged in reaches 1, 2, and 3 generally migrated upstream during the spring. Spring movements of spawning-sized trout (65% >250 mm) illustrate that wild rainbow trout migrate from lower sections of the Big Wood River (and possibly from Magic Reservoir) to spawn in upstream reaches. We recovered two additional trout in the spring of 1987 that had migrated upstream from summer and fall tagging sites in Reach 4.

Trout tagged in reaches 1, 2, and 3 also exhibited downstream movements. Downstream movements occurred during all seasons, though most (64%) of the trout that migrated downstream were recovered in the fall or winter. Downstream movements during this period may reflect winter cover-seeking behavior. Additional recaptures will help define migration patterns in the Big Wood River.

Most recaptured trout exhibited no movements, **suggesting** that they maintain limited home ranges. Of 248 recaptured trout, most (89%) were recaptured within 1 km of the release site. We did not recapture any trout originally tagged in reaches 5, 6, and 7 that exhibited movements (Figure 4).

The operation of the Glendale Diversion (river km 11.3) dramatically effects movements of trout. A berm is bulldozed across the Wood River at the diversion, which blocks all movements during the irrigation season. In most years, this occurs between early July and early December. During drought years, the berm may be placed as early as April. If spring flows are not sufficient to breach the berm, spring-spawning rainbow trout cannot reach upriver areas to spawn.

Table 8. Comparison of back-calculated total lengths at each annulus for rainbow trout from selected Idaho waters.

Location	Length at age 1	2	3	4	5	6	Reference
Big Wood River	100	176	279	358	461	--	Present study
Silver Creek	112	208	280	349	--	--	Thurow (1978)
South Fork Boise River	135	210	300	357	414	--	Mate (1977)
Henrys Fork Snake River (McCrea Bridge to Big Springs)	111	217	322	391	488	546	Coon (1978)
Henrys Fork Snake River (Buffalo River to Last Chance)	129	211	297	369	458	555	Rohrer (1983)

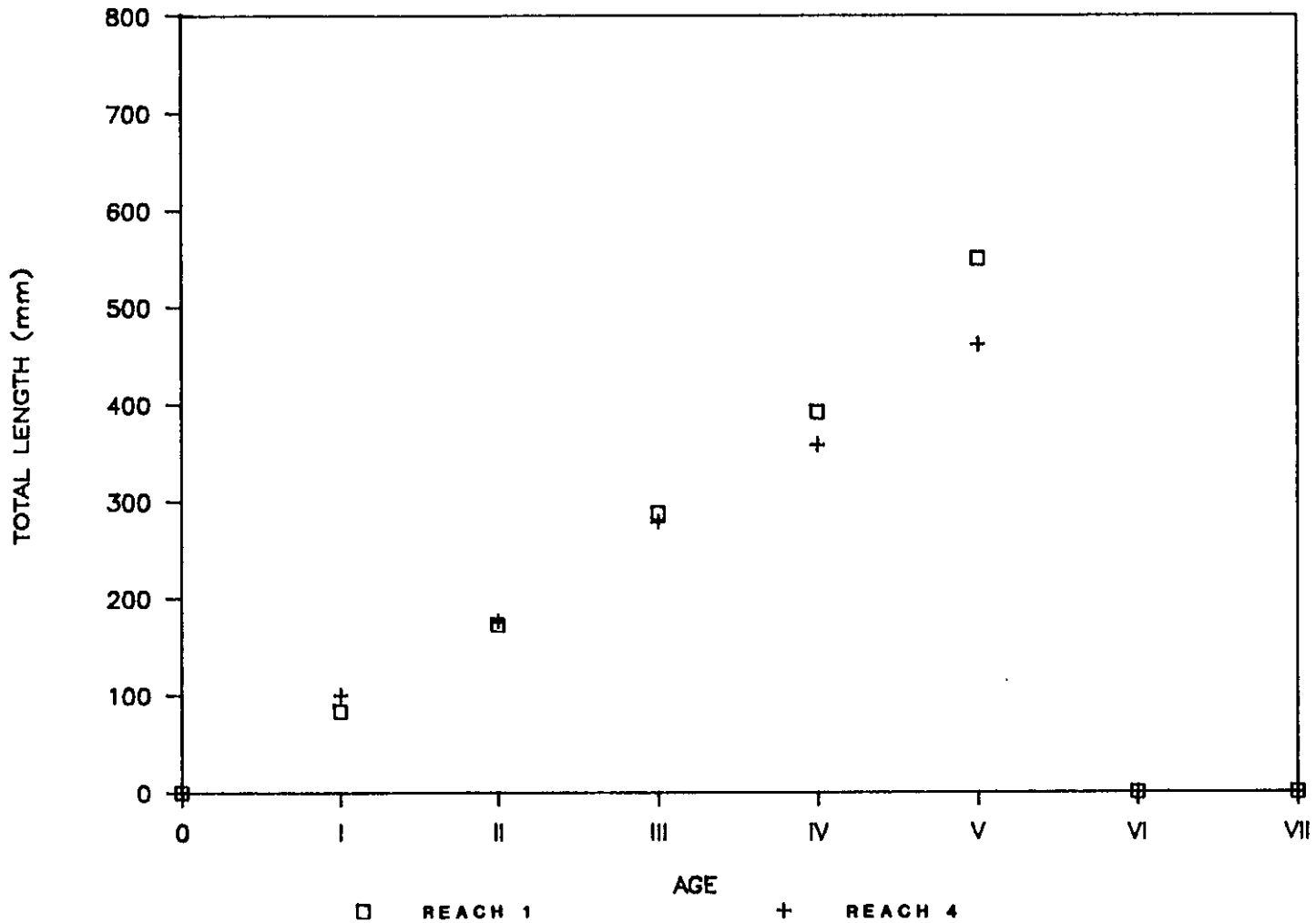

Figure 13. Length-at-age for wild rainbow trout from reaches 1 and 4, Big Wood River, 1986.

Brown Trout

A significant number of mature brown trout migrated from Magic Reservoir in the fall of 1986 to spawn in a 11.3 km reach of the Big Wood River. In July, brown trout comprised 1% of the trout in Reach 1. The percentage of brown trout increased to 38% by October 24. Eighty-one percent exceeded 300 mm, 60% exceeded 400 mm, and 26% exceeded 500 mm.

Initial spawning activity was observed on October 16. On November 17, a survey was conducted by foot; and on November 19, we completed a helicopter redd survey. A total of 122 redds were observed. One pair of fish remained on a redd. An angler recaptured a brown trout in Magic Reservoir in winter that was originally tagged in Reach 1 in the fall.

It is currently unknown where the progeny of these brown trout rear. We observed nine brown trout in Reach 1 during spring and summer electrofishing surveys. If spawning is successful, progeny may rear in smaller tributaries, or migrate to Magic Reservoir.

A significant number (nearly 50%) of the redds constructed in 1986 were dewatered between December and March due to drought conditions.

Other Species

We recaptured 39 fin-clipped, hatchery-reared rainbow trout. Thirty-eight exhibited no movement and one migrated from Reach 1 to Magic Reservoir between summer and fall.

Hatchery-reared rainbow trout released at the Hulen Meadows Bridge migrated upstream into the catch-and-release area. During summer and fall electrofishing surveys, 37% and 46%, respectively, of the trout captured were hatchery-reared rainbow trout stocked in 1986.

We recaptured one brook trout in Reach 1 that had remained in the same location.

The Sport Fishery

Angler Effort

Bank anglers fished an estimated 29,222 hours on sections 3, 4, 6, 7. 8, 10, 11, and 12 of the main Big Wood River between June 14 and November 14, 1986 (Appendix F). Approximately 51 km of stream were censused (23 km excluded). No tributaries (Trail and Warm Springs creeks and the East and North forks of the Big Wood River) were censused. Consequently, the effort estimate represents only a portion of the total effort on the Big Wood River drainage above Magic Reservoir. Effort averaged 572 hours/km stream censused, which equates to approximately 163 angler trips per lm censused (at 3.5 hours per trip). Total effort increased markedly during July and peaked in August (Figure 14). During the remainder of the season. effort declined.

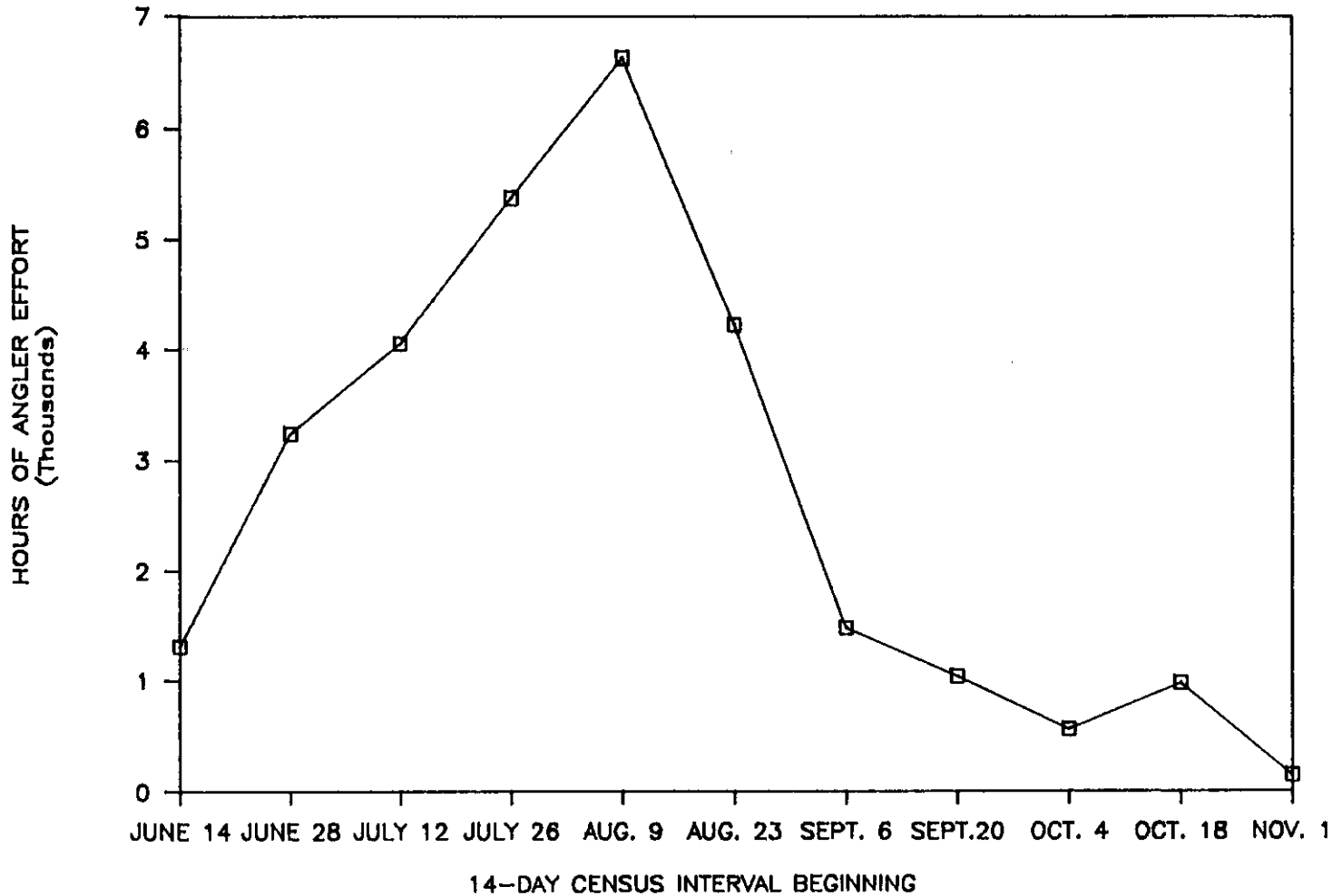

Figure 14. Distribution of angler effort on censused sections of the Big Wood River, 1986.

Angler effort was most intensive in sections 7, 8 and 10 where 914 to 1,319 hours of effort were expended per km (Appendix F). All three sections contain public access sites and sections 8 and 10 received extensive stockings of catchable rainbow trout. Effort on the remainder of the Big Wood River ranged from 370 to 600 hours/km.

Catch

Catch rates (fish harvested and released per hour) for all species combined averaged 1.18 fish/hour and ranged from a peak of 1.95 fish/hour in Section 11 to a low of 0.74 fish/hour in Section 12 (Appendix G). Catch rates exceeded one fish per hour in all sections except 3 and 12.

Harvest rates (fish harvested per hour) for all species combined averaged 0.45 fish/hour and ranged from 0.30 to 0.78 fish/hour (Appendix G). Anglers harvested approximately 12,366 game fish from the 51 km of stream censused in 1986 (Table 9). Hatchery-reared rainbow trout comprised a majority (65.5%) of the harvest followed by wild rainbow trout (34%) and brook trout (0.5%). Hayspur Hatchery personnel estimated that 17,800 hatchery-reared rainbow trout were stocked in the censused sections in 1986 (Table 10). Anglers harvested approximately 46% of the trout stocked. Returns to the creel ranged from 30% to 72%. Sections 6 and 7 received the fewest catchable trout and sections 3, 8, 10, and 12 the most. Sections 3, 8, and 10 sustained the largest return-to-the-creel of those sections that received stockings of 2,000 or more trout. Several factors may contribute to the harvest of hatchery trout: (1) public access, (2) large angler effort, (3) suitable holding water within the section, and (4) multiple monthly stockings.

Harvested wild rainbow trout ranged from 166 to 446 mm and averaged 299 mm (Figure 15). A majority of the harvest was comprised of two- and three-year-old trout ranging from 170 to 360 mm. Anglers apparently released trout less than 200 mm and selected larger trout. Two percent of the harvested trout were less than 200 mm, 55% exceeded 300 mm, and 6% exceeded 400 mm. In contrast, electrofishing data from censused sections (reaches 2 to 7) exhibited 41% of the trout less than 200 mm, 26% exceeded 300 mm, and 5% exceeded 400 mm.

Brook trout were most prevalent in sections 1 and 2 and ranged from 191 to 272 mm long. Anglers also caught brown trout in Section 1 but numbers were not estimated. Few anglers harvested mountain whitefish; we checked three in the creel.

A large proportion of the total catch was released. Anglers caught an estimated 35,626 trout and released 23,260 (65%) (Table 9). The percent of the catch which was released varied by section and ranged from 23% in Section 12 to 100% in the catch-and-release area (Section 11) (Table 11). Anglers in sections 6 and 7 released nearly 80% of the catch voluntarily. Due to the large amount of catch-and-release fishing, it is likely that individual trout were caught and released several times during the season. As an example, densities of trout averaged 600 fish per km in an electrofishing reach within Section 7. Anglers caught an estimated 2,070

Table 9. Estimated harvest and catch (fish harvested and released) of game fish by anglers from sections of the Big Wood River, 1986.

Section	Harvest (95% confidence interval in parentheses)					Catch (95% confidence interval)	Catch per km
	Hatchery rainbow trout		Wild rainbow trout		Total		
3	1,030 (713)	61%	642 (444)	38%	1,689[a] (1,169)	3,800 (1,832)	413
4	671 (462)	44%	853 (589)	56%	1,524 (1,051)	2,813 (2,649)	879
6	565 (423)	48%	611 (458)	52%	1,176 (881)	5,172 (2,788)	761
7	235 (225)	25%	706 (673)	75%	941 (898)	4,348 (1,955)	2,070
8	1,443 (947)	78%	407 (267)	22%	1,850 (1,214)	4,289 (2,715)	932
10	1,789 (1,806)	79%	476 (480)	21%	2,265 (2,286)	4,390 (2,237)	1,186
11	----------Catch-and-release----------					7,088 (6,224)	854
12	2,366 (1,849)	81%	555 (434)	19%	2,921 (2,283)	3,726 (2,333)	282
Total	8,099 (6,425)	65%	4,250 (3,345)	34%	12,366 (9,782)	35,626 (22,733)	698

[a]Includes 17(12) brook trout.

Table 10. Estimated return-to-the-creel of hatchery rainbow trout stocked in sections of the Big Wood River, 1986.

Section	Estimated hatchery rainbow trout stocked	Estimated harvest	Return-to-the-creel
3	2,000	1,030	52%
4	1,400	671	48%
6	800	565	71%
7	600	235	39%
8	2,000	1,443	72%
10	3,000	1,789	60%
12	8,000	2,366	30%
Total	17,800	8,099	46%

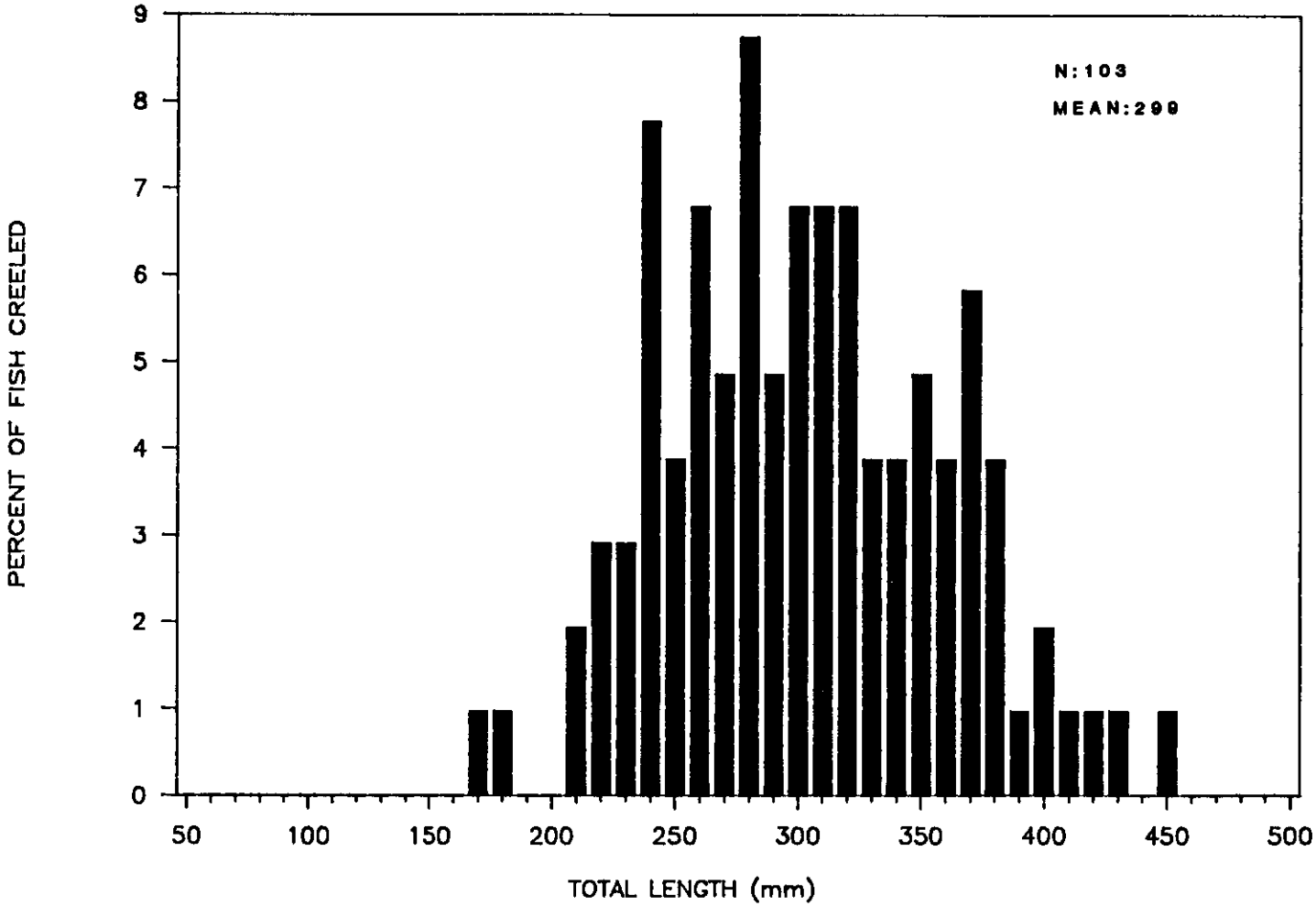

Figure 15. Length frequency of wild rainbow trout harvested by anglers, Big Wood River, 1986.

Table 11. Catch and harvest rates (fish/hour) and the percentage of trout released by anglers using various gear types on the Big Wood River, 1986.

Section	Harvest rate				Catch rate				% trout released				Total
	Bait	Lure	Fly	Multiple	Bait	Lure	Fly	Multiple	Bait	Lure	Fly	Multiple	
3	0.72	0	0.17	0.10	1.03	0.35	0.98	0.40	30	100	83	75	56
4	0.79	2.00	0.22	1.00	1.15	5.00	1.98	1.00	31	60	89	0	46
6	0.42	0	0.18	0.93	0.95	0	1.68	1.20	56	--	89	22	77
7	0.48	2.50	0.19	--	0.58	4.17	2.17	--	18	40	91	--	78
8	0.64	0	0.13	--	0.76	0.0	1.56	--	16	--	92	--	57
10	0.88	0.67	0.08	--	1.06	0.0	1.95	--	17	--	96	--	48
11	----Catch-and-release----				--	--	1.96	--	--	--	100	--	100
12	0.85	2.00	0.13	0.71	0.98	0	0.38	0.71	14	--	67	0	23
Total (excluding Section 11)	0.68	0.54	0.16	0.55	0.93	1.14	1.49	0.75	26%	53%	89%	26%	65%

fish per km during the season. Consequently, each trout was caught and released an average of 3.5 times during the season. Within the catch-and-release area, anglers caught an estimated 854 fish/km and densities averaged 433 trout/km. Consequently, each trout was caught an average of twice.

Angler Attributes

Idaho residents comprised the majority (60%) of the anglers we interviewed on the Big Wood River in 1986 (Table 12). All anglers fished from the bank and most used bait (53%) or flies (36%). Anglers in sections 6 and 7 used predominately flies and lures.

Anglers using flies as terminal tackle enjoyed larger catch rates than anglers using other tackle (Table 11). Fly anglers released a majority (89%) of their catch. Although anglers using bait caught fewer fish per hour, they exhibited the largest harvest rates and the smallest release rates.

A small proportion of the anglers harvested a disproportionate number of fish. Of 328 anglers censused, 65% did not harvest any trout, 16% harvested one trout and 10% harvested two trout. Only 9% of the anglers harvested three or more trout and just 2% took a limit of six trout.

The Winter Fishery

The Big Wood River remains open to angling from November 30 to March 31. We interviewed anglers during this period to evaluate the winter fishery.

Sixty-three anglers were interviewed between December 1986 and March 1987 (Appendix H). Most of the angling effort occurred near bridges where access was convenient. Effort was largest in sections 11 and 3 (especially near Broadford and Star bridges).

Catch rates averaged 0.89 fish/hour in general regulation reaches and 1. 89 fish/hour in the catch-and-release area (Section 11) (Appendix H). Seventy-eight percent of the catch was released compared to 65% during the general season (May to November). Anglers estimated that 37% of the released trout exceeded 300 mm compared to 17% during the general season.

Ninety percent of the anglers were Idaho residents and most (59%) used flies (Appendix H).

Table 12. Angler residence and methods used on the Big Wood River, 1986.

Section	Total anglers interviewed	Percent anglers		Percent using			
		Resident	Nonresident	Bait	Lure	Fly	Multiple
3	124	69	55	54	7	36	3
4	32	75	25	63	13	22	2
6	59	53	47	47	5	41	7
7	47	40	60	34	6	60	0
8	74	51	49	58	9	33	0
10	48	56	44	64	9	27	0
11	53	32	68	None allowed	2	98	0
12	64	67	33	53	8	33	7
Totals (excluding Section 11)	448	60	40	53	8	36	3

Evaluation of Special Regulations

Big Wood River

Electrofishing reaches 2 through 5 (general angling regulations) were selected as control areas for Reach 6 (catch-and-release regulations). I excluded Reach 1 due to the influence of Magic Reservoir and Reach 7 due to its geomorphic characteristics. Several variables (size of stream, habitat types, cover components, hatchery rainbow trout introductions) differ among the reaches so a direct control and treatment comparison is difficult. A more valid evaluation of catch-and-release regulations would have been a pre- and postimplementation study. Unfortunately, no data were obtained prior to the implementation of the regulation and the 1986 data is the initial postevaluation data.

During summer sampling, wild rainbow trout were more abundant in the general regulation reaches than in the catch-and-release reach (Table 13). Densities of wild rainbow were more than twice as large in the general reaches. The density of trout larger than 300 mm was nearly double that in the catch-and-release reach.

In contrast, the density of wild rainbow trout in the general reaches declined dramatically between summer and fall, while trout densities in the catch-and-release reach increased. Rainbow trout densities declined from 675 trout/km and 381 trout/hectare in summer to 298 trout/km and 162 trout/hectare in fall within general reaches (Table 13). The density of trout larger than 300 mm remained similar in the general reaches and increased in the catch-and-release reach. Fall densities of wild rainbow trout exceeding 300 mm were nearly identical in the general and catch-and-release reaches.

Wild rainbow trout in the catch-and-release reach averaged 243 mm during summer as compared to 217 mm in general regulation areas (Table 13) . The proportion of trout larger than 300 mm was 1.6 times larger in the catch-and-release reach. During fall sampling, the average length and percentage of trout larger than 300 mm were larger in the general regulation areas as compared to catch-and-release areas.

Angler effort was larger in the general regulation areas as compared to catch-and-release areas (Table 14). Within general reaches, effort averaged 694 hours/km as compared to 438 hours/km. in catch-and-release reaches. The lack of public access in the upper 60% of the catch-and-release reach may suppress effort. The lesser effort in the catch-and-release reach was not due to poor angling. Anglers enjoyed better catch rates in the catch-and-release reach (1.95 fish/hour) as compared to anglers in general areas (1.17 fish per hour) (Table 14).

Slightly more anglers used bait (52%) than lures, flies, or multiple gear in general regulation areas. Within the catch-and-release reach, although flies were not mandatory, only 2% of the anglers used lures. A majority of the anglers in the catch-and-release reach were nonresidents. Only 33% of the anglers in the catch-and-release reach were residents compared to 59% in general regulation areas (Table 14).

Table 13. Size and abundance of trout in reaches of the Big and Little Wood rivers managed under catch-and-release (CR) and general angling regulations, 1986.

Season	Regulation	Reach	Size				Abundance			
							Total		>300 mm	
			Mean total length (mm)	% >300 mm	% >400 mm	% >500 mm	#/km	#/ha	#/km	#/ha
Big Wood River - Wild Rainbow Trout										
Summer	CR	6	243	31	6	1	, 238	158	74	49
	General	2-5	217	19	4	0	675	381	128	72
		(Range)	(192-236)	(6-25)	(2-6)	0	(350-1,068)	(232-521)	--	--
Fall	CR	6	220	25	9	0	377	250	94	63
	General	3, 4	246	37	6	0.3	298	162	110	60
		(Range)	(235-250)	(34-44)	(4-10)	(0-0.6)	(166-369)	(81-213)	--	--
Little Wood River - Brown Trout										
Spring	CR	8	232	21	8	2.4	276	215	58	45
	General	9	209	8	2	0	192	131	15	10
Summer	CR	8	218	18	5	0.6	275	214	50	39
	General	9	214	5	0	0	308	209	15	10
Fall	CR	8	241	24	9	0.9	447	349	107	84
	General	9	285	35	12	0	208	142	73	50

Table 14. Creel census statistics for the sport fishery in reaches of the Big and Little Wood rivers managed under catch-and-release (CR) and general regulations, 1986.

Parameter	Big Wood River		Little Wood River		
	CR Section 11	General Mean of sections 3, 4, 6, 7, 8, and 10	General Section 1	CR Section 2	General Section 3
Angler effort (hr)	3,635	20,552	1,986	938	1,998
Hours per km	438	694	1,241	213	294
Hours per ha	290	383	605	166	200
Catch rate (fish harvested and released per hr)	1.95	1.17	0.70	0.95	0.55
Catch per km	854	838	869	203	162
Release rate (fish per hr)	1.95	0.74	0.39	0.95	0.36
Fish released per km	854	519	484	203	106
Percent lures	2%	8%	11%	0%	6%
Percent flies	98%	37%	36%	100%	35%
Percent Idaho residents	32%	59%	78%	83%	91%

Little Wood River

Electrofishing results from Reach 9 (general angling regulations) were compared with those from Reach 8 (catch-and-release regulations). As in the Big Wood River, several variables, especially cover components, differ between reaches and comparisons are difficult. Unfortunately, pre- and postimplementation data are also unavailable for the Little Wood River.

Densities of brown trout larger than 300 mm were larger in the catch-and-release reach as compared to the general regulation reach (Table 13). Trout larger than 300 mm were 3 to 4 times more abundant during the spring and summer, and almost 50% more abundant in the fall.

During spring sampling, brown trout in the catch-and-release reach averaged 232 mm compared to 209 mm in the general regulation reach. The percentage of trout larger than 300 mm, 400 mm, and 500 mm was 2.6, 4, and 2.4 times greater than in the general regulation reach (Table 13). In summer, the mean total lengths were similar, although the proportion of large fish was much larger in the catch-and-release reach (Figure 16). In the fall, the average length of brown trout and the percentage of trout larger than 300 mm and 400 mm were larger in the general regulation reach.

Length-weight relationships for brown trout from the catch-and-release reach and general regulation reaches of the Little Wood River were similar and comparable to those for Big Wood River brown trout (Figure 11).

Angler effort was larger on Section 1 than in sections 2 and 3 (Table 14 and Appendix I). Anglers concentrated and camped at the Preacher Bridge location in Section 1. The lesser effort in the catch-and-release reach (Section 2) was not due to poor angling. Anglers in the catch-and-release reach enjoyed catch rates averaging 0.95 fish/hour compared to 0.55 to 0.70 fish/hour in the general regulation areas (Appendix J).

Slightly more anglers used bait than flies and lures in general regulation reaches (Table 14 and Appendix J). Fly fishing was mandatory in the catch-and-release area. Similar proportions of the anglers in general and catch-and-release areas were Idaho residents.

Trout-Habitat Relationships

Within mapped reaches of the **Big** Wood River, low-gradient riffles were the dominant habitat type, accounting for 57% of the total surface area (Appendix K). Lateral scour pools were the next most common habitat type, accounting for 24% of the surface area. Backwater pools, convergent channel pools, dammed pools, plunge pools, and secondary channel pools were infrequent. Despite having large individual dimensions, glides were not common and comprised 12% of the surface area. Steep riffles and rapids were also uncommon.

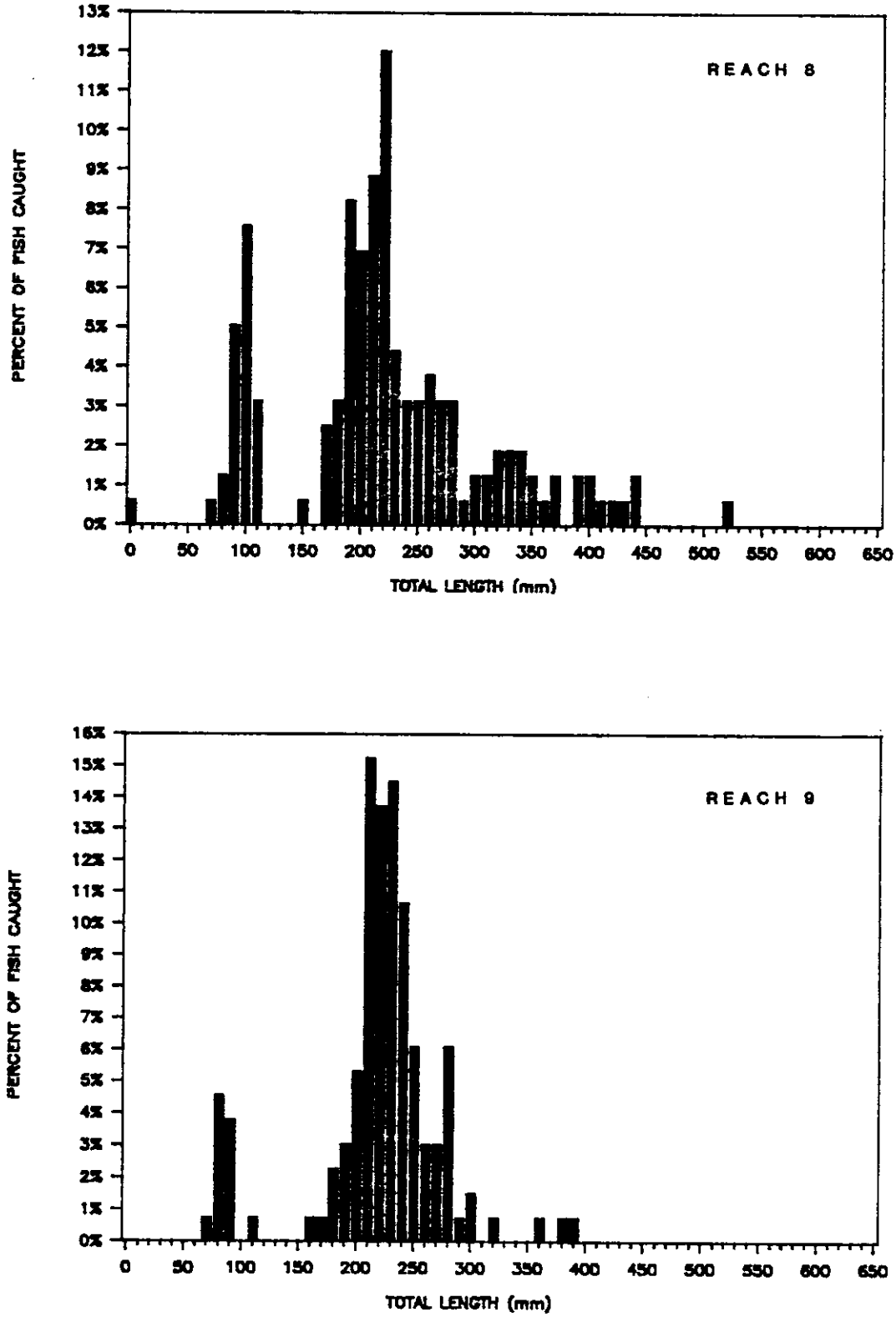

Figure 16. Length frequencies of brown trout captured in Reach 8 (catch-and-release) and Reach 9 (general regulations) of the Little Wood River, July 1986.

Large woody debris was the most abundant cover component, followed by roots and undercut banks (Appendix L). Although we did not attempt to quantify depth as a cover component, it is probably an important component in pools. As Sisson et al. (1982) observed, cover quantity and diversity was generally largest in pools.

Densities of age 1 and older wild rainbow trout tended to increase as the areas of lateral scour pools, rapids, riffles, steep riffles, and plunge pools increased (Table 15). Our surveys suggest that few trout reside in rapids and steep riffles, but these habitat types contribute to the overall trout density within the stream reach. This is because pools are commonly found both above and below steep riffles and rapids, which function as hydraulic controls.

Woody debris, including root clusters, root wads, tree stumps, and large woody debris, were preferred cover components for wild rainbow trout (Table 15). Densities of trout increased as the area of these components increased. Conversely, densities of wild rainbow trout were negatively correlated with the areas of unanchored, small woody debris and grass.

Correlations were also completed after excluding Reach 6 (catch-and-release) from the remaining reaches managed under general angling regulations. Although the relationships did not change appreciably, correlations of fish density with root clusters, debris jams, large woody debris, and stumps were strengthened (Table 15).

Snorkel surveys revealed that densities of wild rainbow trout were larger in habitats with cover components than in areas with no cover or riprap (Table 16) . Trout densities (fish/100 m) were eight to ten times larger where cover components were present. We observed an average of 17.4 trout/100 m^2 at sites with cover, 1.2 trout/100 m^2 with no cover, and 2.1 trout/100 m^2 with riprap (Table 16). An analysis of variance ($P>.05$) found no significant difference between the density of trout at locations with no cover and locations with riprap. .

Irrigation Diversions

A total of 16 irrigation canals of sufficient size to attract fish divert water from the Big Wood River above Magic Valley Reservoir (Table 17). Canals are present between Hidden Hollow Bridge (river km 37.8) and Stanton Crossing (river km 3.5). The official irrigation season begins April 15 and terminates on September 30. However, irrigators have the option of operating canals throughout the year for stock watering and other uses. The irrigation district maintains records during their official April to September season only.

The amount of water diverted ranged from 5.7 to 298 cfs in 1986 (Table 17). The District Canal, located near Bellevue, is entitled to up to 600 cfs. Surveys conducted in 1949 suggested that the Baseline Canal sustained the largest populations of trout and the Black, Brown, District, Dittoe, Glendale, and Hiawatha canals all sustained at least moderate trout populations (Hauck 1949) .

Table 15. Average Pearson correlations between density of wild rainbow trout and various habitat types and cover components, Big Wood River, 1986.

	Habitat types								
	Back water pools	Convergent channel pools	Glides	Lateral scour pools	Plunge pools	Riffles	Rapids	Secondary channel pools	Steep riffles
Density of wild rainbow trout Reaches 1 through 7	-0.178	-0.286	-0.051	+0.754	+0.515	+0.648	+0.736	+0.364	+0.580

	Cover components										
	Root clusters	Brush	Debris jams	Grass	Large woody debris	Riprap	Root wads	Unachored small debris	Stumps	Trees	Undercut banks
Density of wild rainbow trout Reaches 1 through 7	+0.845	-0.056	+0.148	-0.440	+0.434	-0.293	+0.862	-0.895	+0.524	+0.078	-0.213
Density of wild rainbow trout excluding Reach 6	+0.865	-0.171	+0.352	-0.571	+0.901	-0.033	+0.846	-0.901	+0.571	-0.039	-0.149

Table 16. Density of wild rainbow trout observed in snorkeling transects in association with cover, no cover, and riprap, Big Wood River, 1986.

Category	Reach (trout/100 m)					Mean trout/ 100 m	Mean trout/ 100 m	Variance	Standard deviation	Sample size
	1	2	3	4	6					
Cover component	12.0	51.8	126.4	43.8	43.9	57.4	17.4	0.81	0.284	90.0
No cover component	0.9	9.1	9.7	4.1	4.0	5.7	1.2	0.001	0.025	85.0
Riprap	--	8.8	--	9.1	6.4	8.2	2.1	0.001	0.028	9.0

Table 17. Active irrigation canals on the Big Wood River above Magic Reservoir, 1986.

Canal name	Headgate location	Dates of operation in 1986	1986 maximum flow (cfs)
Meiser	Hidden Hollow	May 2 to Aug 14	9.8
Hiawatha	Starweather	May 1 to Sep 30	66.0
Osborn	Zinc Spur	May 5 to Sep 30	12.8
Purdum	Deer Creek Slough	May 11 to Sep 30	7.0
Cove	Colorado Gulch	Apr 26 to Sep 30	26.0
Broadford Slough	above Star Bridge	---year-round---	17.4
Kohler	below Star Bridge	May 29 to Sep 30	9.2
District	Bellevue	May 1 to Sep 30	298.0
Bannon	above Glendale	May 28 to Sep 30	5.7
Glendale	Glendale	May 3 to Sep 30	63.2
Baseline	Glendale	Apr 22 to Sep 30	149.0
Ditto	Bypass	May 6 to Sep 30	21.1
Brown	Bypass	May 20 to Sep 30	15.9
Black	Dragonwood	Apr 29 to Sep 14	44.0
Graf	Wood River Ranch	May 3 to Sep 1	35.0
Uhrig	Janke Ranch	May 17 to Sep 30	14.0

On October 9, 1986, we completed a visual survey of approximately 5.6 km of the Hiawatha Canal downstream from the headgate. A total of 13 rainbow trout between 200 and 400 mm were observed. Ten of the trout were in the upper 0.8 km of the canal. Intensive surveys of canals will be completed in 1987.

On July 17, 1986, a crew of IDFG employees, local anglers, and guides salvaged the Wood River between the Glendale Bridge and diversion berm. A backpack shocker was also used to salvage several pools within 3 km of the berm. A total of 563 trout were salvaged and reintroduced in the Big Wood River between Hailey and Ketchum. Ninety-six percent of the fish were wild rainbow, 2% brown, and 1% hatchery-reared rainbow trout. Wild rainbow trout ranged up to 408 mm.

DISCUSSION

Trout Popoulation Indices

Based on preliminary data, annual mortality rates of age 3 and older wild rainbow trout in the Big Wood River are large. Within reaches 2 to 5 and 7, mortality rates equaled 76% and 78X, respectively, for trout sampled by electrofishing and angling (Table 18). Exploitation rates by anglers equaled 48% for age 3 and older fish. As a result, angling mortality (F) comprised the bulk of the annual mortality within those stream reaches. Angling mortality may also be responsible for the decline between the summer and fall sampling.

Within the catch-and-release area (Reach 6), annual mortality equaled 70% for trout sampled by electrofishing (Table 18). Despite no legal exploitation, I applied a 10% level of exploitation to reflect maximum potential hooking mortality based on literature Mongillo (1984) summarized. Even with such a large hooking mortality, natural mortality (M) comprises the bulk of the annual mortality.

It appears that compensatory mortality may be occurring (Ricker 1975). As angling mortality increased, natural mortality decreased in reaches 2 to 5 and 7. Within Reach 6, the reverse is true. Unfortunately, habitat condition varies among the reaches. It appears that habitat in Reach 6 is not capable of supporting large numbers of large trout. The larger densities of trout in reaches 2 to 5 and 7 support this hypothesis.

Habitat restoration may reduce total annual mortality in many reaches, particularly in Reach 6. In reaches with excessive angling mortality, exploitation rates may be adjusted to provide a more desirable level of angling mortality as Lackey and Hubert (1978) report. Exploitation rates of wild rainbow trout are not distributed uniformly between all size classes (Table 19). This factor can also be applied to adjust angling mortality.

Table 18. Estimated instantaneous rates of natural mortality (M) and fishing mortality (F) using instantaneous mortality (Z), total annual mortality (A), and exploitation (E) for wild rainbow trout age 3 and older, where M=Z-F and F=EZ/A (Ricker 1975).

Stream reaches	Regulation type	Sampling method	A	M	F	Z	E
2, 3, 4, 5, and 7	general	angler creel	0.78	0.56	0.89	1.45	0.48
2, 3, 4, 5, and 7	general	electrofishing	0.76	0.56	0.89	1.41	0.48
6	catch-and-release	electrofishing	0.70	0.99	0.17	1.16	0.10

Table 19. Estimated exploitation rates (E) of wild rainbow trout using total harvest (H) and population estimates (N) from reaches 2, 3, 4, 5, and 7 of the Big Wood River, 1986, where E=H-C.

Mean exploitation of wild rainbow trout by size class				
≥100 mm	100-200 mm	200-300 mm	300-400 mm	≥400 mm
17%	1%	20%	52%	33%

Habitat Concerns

The Big Wood River drainage displays typical characteristics of geological youth, including steep gradients; shallow, well-drained soils; and large bedloads. These factors combine to create a runoff cycle of widely fluctuating flows. The river has continually adjusted its downstream profile and cross sectional area in a quest for equilibrium. Native vegetation was well adapted to the fluctuations, exhibiting fast growth, water tolerance, short life spans, and dense fibrous root systems that were effective in stabilizing stream channels. Historically, the entire alluvial floodplain functioned as a unit with the stream channel.

Since the settlement of the Wood River Valley, dramatic man-induced changes have occurred in the watershed. The most significant changes have included channel relocation, diking, channel clearance and placement of rock revetments (riprap) (Irizarry 1969). Concurrent with channel alterations has been removal of riparian vegetation. Alterations began in the 1940s and continue today. Alterations of the stream channel and riparian habitat adversely affect stream hydraulics (Marston 1982; Bottom et al. 1985), nutrient pathways (Schlosser 1982), invertebrate production (Benke et al. 1985), and fish production.

The reduction in trout populations following stream alterations is well documented in Idaho and Montana. Within Idaho, portions of 45 streams, totaling 1,830 km, were surveyed in 1967 and 1968 (Irizarry 1969). Undisturbed stream reaches outproduced altered areas with 1.5 to 112 times the biomass of game fish. Unaltered reaches supported seven times more catchable-sized trout and eight times the biomassof trout. Alterations reduced fish production by 80 to 90%. In Montana, undisturbed reaches of 13 streams supported 3.5 times the number and 9 times the biomass of trout in altered reaches (Peters and Alvord 1964). Whitney and Bailey (1959) documented a 94% decrease in number and biomass of trout following stream alteration.

Within the Big Wood River, fish populations in altered stream reaches have declined. Irizarry (1969) found game fish populations in altered reaches of the Big Wood River were one-tenth of those in unaltered, or "natural" reaches. In 1986, trout densities were eight to ten times larger in unaltered reaches where cover components were present than in reaches with no cover or rock revetments. Densities of wild rainbow trout increased as the area of woody debris cover increased.

Our preliminary data illustrates that fish populations will benefit if stream alterations are restricted. The impacts of floodplain development may be lessened by stipulating: (1) maintenance of a riparian vegetation buffer zone between the river channel and developments, (2) maintenance of all natural floodway overflow channels, and (3) allowance of natural sheet flooding. Where stabilization of the channel is necessary, alternatives other than rock revetment should be applied. Within the Big Wood River, rock revetment is detrimental to fish populations and it creates adverse hydrologic impacts. As Williams and Krupin (1984) observed, a downstream

progression of bank cutting, erosion, and bank failure can occur following installation of rock revetment. Excess flow energy is also redirected to the streambed, resulting in lateral scour and undercutting of the area below the revetment. This results in failure of the revetment and additional bedload movement.

Finally, the fish populations will benefit if measures are applied to restore channel stability and riparian vegetation in altered reaches. A joint agreement between the U.S. Forest Service, U.S. Bureau of Land Management, Idaho Department of Transportation, Idaho Department of Fish and Game, Blaine County, and the City of Ketchum will implement a demonstration project in the Big Wood River above Ketchum (Anonymous 1987). The project will test the effectiveness of drop structures and vegetative management in restoring channel stability. We will monitor the effects of the project on fish populations and fish habitat.

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APPENDICES

Appendix A. Fish present in the Wood River drainage.

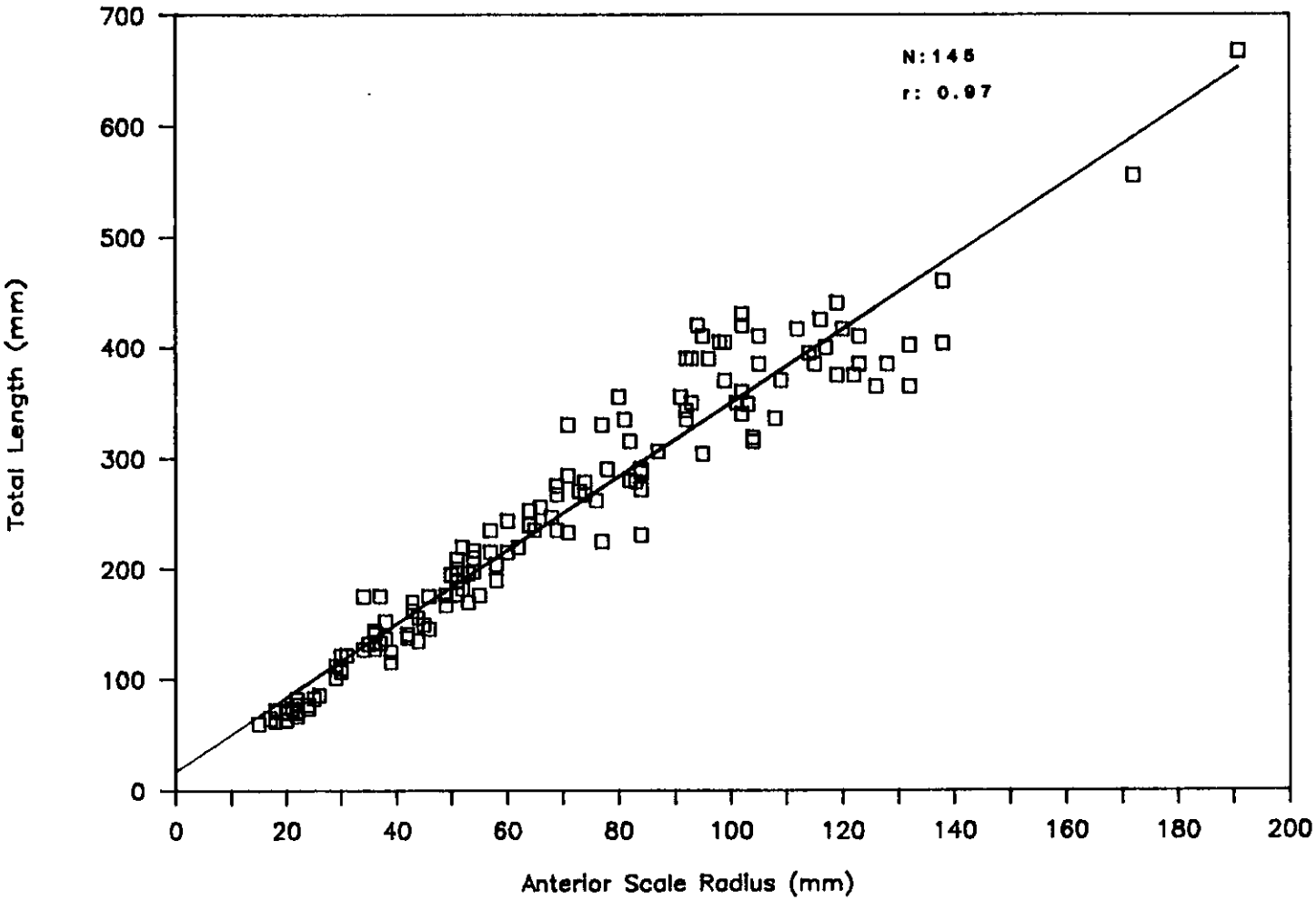
Common name	Scientific name	Status
Redband trout (rainbow)	Salmo gairdneri sp.	Indigenous
Mountain whitefish	Prosopium williamsoni	Indigenous
Wood River sculpin	Cottus leiopomus	Endemic
Leatherside chub	Gila copei	Indigenous
Longnose dace	Rhinichthys cataractae	Indigenous
Speckled dace	Rhinichthys osculus	Indigenous
Bridgelip sucker	Catostomus columbianus	Indigenous
Largescale sucker	Catostomus macrocheilus	Indigenous
Utah chub	Gila atravia	Indigenous
Redside shiner	Richardsonius balteatus	Indigenous
Rainbow trout	Salmo gairdneri	Introduced
Brown trout	Salmo trutta	Introduced
Brook trout	Salvelinus fontinalis	Introduced
Cutthroat trout	Salmo clarki sp.	Introduced
Smallmouth bass	Micropterus dolomieui	Introduced
Yellow perch	Perca flavescens	Introduced

Appendix B. Electrofishing reaches in the Big and Little Wood rivers, 1986.

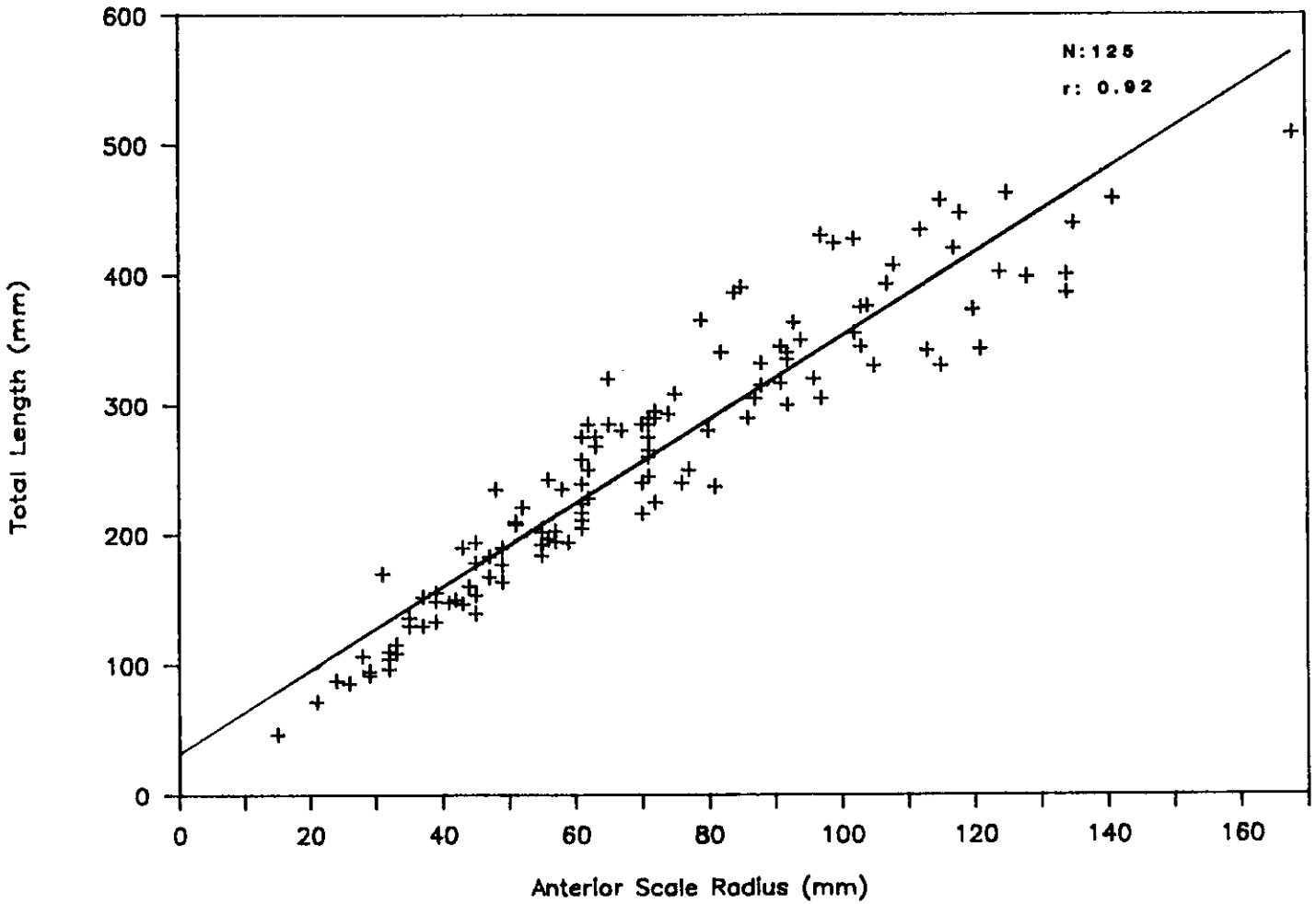
Electrofishing reach	Approximate location	Fishing regulations	Habitat alterations	River kilometer (midpoint)	Total length of reach (m)
1	Wood River Ranch	General	Glendale Diversion restricts summer and fall fish movements; periodically dewatered	9.7	1,849
2	Colorado Gulch to Hailey Park	General	Riprap and channel alterations	27.3	2,000
3	Starweather Subdivision	General	Irrigation diversion at bottom of reach	36.2	1,067
4	Gimlet Subdivision	General	Extensive riprap and riparian area denudation	41.0	1,979
5	Adams Gulch Bridge to Hulen Meadows	General	Extensive riprap and riparian area denudation	52.0	1,183
6	Hulen Meadows Bridge to Lake Cr. trailhead	Catch-and-release	Isolated riprap	53.9	1,149
7	Kendall Gulch to Boulder Creek	General	Limited changes	68.4	1,081
8	Little Wood River, Bear Tracks	Catch-and-release	Livestock impacts to riparian areas	89.3	1,296
9	Little Wood River, Pagari Bridge	General	Livestock impacts to riparian areas	84.2	926

Appendix C. Data used to calculate population estimates for electrofishing reaches of the Big Wood River, 1986.

		Marking runs		Recapture runs			
Reach	Season	Date	No. fish marked	Date	No. fish captured	Recaptured fish	Type of estimate
1	Spring	5/3	59	5/6	31	3	Petersen
	Summer	7/27	218	7/31	244	36	Petersen
	Fall	10/16	131	10/24	80	20	Petersen
2	Spring	5/5	55	5/8	57	2	Petersen
	Summer	7/29	91	8/1	54	6	Schnabel
			138	8/8	115	7	
			243	8/15	81	9	
3	Spring	5/15	17	5/19	29	0	none
	Summer	8/5	66	8/11	63	3	Schnabel
			124	8/19	50	6	
	Fall	10/22	33	10/29	28	3	Schnabel
			61	11/4	9	5	
4	Spring	5/16	52	5/21	6	0	none
	Summer	8/7	89	8/14	63	5	Schnabel
			147	8/24	91	11	
	Fall	10/23	91	10/30	110	12	Petersen
5	Summer	8/26	70	8/29	96	9	Petersen
6	Summer	8/22	126	8/28	78	19	Petersen
	Fall	-	185	10/17	145	32	Petersen
7	Summer	8/27	52	9/2	38	8	Petersen



Appendix D. Anterior scale radius versus total length for wild rainbow trout from the Big Wood River, Reach 1, 1986.



Appendix E. Anterior scale radius versus total length for wild rainbow trout from the Big Wood River, Reach 4, 1986.

Appendix F. Estimated angler effort (hours) by census interval and section, Big Wood River, 1986 (95% confidence intervals in parentheses).

Interval	Beginning	Census section (km) 3 (9.2 km)	4 (3.2 km)	6 (6.8 km)	7 (2.1 km)	8 (4.6 km)	10 (3.7 km)	11 (8.3 km)	12 (13.2 km)	Pooled estimate
1	Jun 14	93	113	474	50	309	62	103	154	1,308
		(111)	(125)	(655)	--	(111)	--	(206)	(230)	(919)
2	Jun 28	411	358	577	322	442	434	312	386	3,242
		(281)	(217)	(300)	(279)	(191)	(326)	(211)	(160)	(1,243)
3	Jul 12	875	280	395	375	585	460	390	695	4,055
		(553)	(188)	(258)	(332)	(346)	(215)	(344)	(254)	(1,138)
4	Jul 26	721	339	533	354	1,007	819	639	959	5,371
		(358)	(180)	(343)	(221)	(276)	(412)	(341)	(314)	(1,090)
5	Aug 9	827	399	882	678	873	743	669	1,551	6,621
		(318)	(328)	(249)	(500)	(437)	(301)	(596)	(830)	(1,781)
6	Aug 23	637	173	633	526	460	473	633	695	4,229
		(383)	(164)	(533)	(325)	(248)	(291)	(493)	(242)	(1,846)
7	Sep 6	176	38	134	80	298	67	448	243	1,483
		(127)	(47)	(140)	(128)	(248)	(91)	(331)	(101)	(655)
8	Sep 20	139	131	186	162	91	107	79	146	1,041
		(134)	(112)	(175)	(117)	(99)	(112)	(106)	(159)	(502)
9	Oct 4	101	28	60	47	65	107	84	71	562
		(84)	(33)	(53)	(45)	(49)	(96)	(100)	(105)	(233)
10	Oct 18	148	42	263	70	0	176	271	9	979
		(217)	(27)	(222)	(111)	--	(320)	(51)	(17)	(253)
11	Nov 1	40	33	0	47	13	0	50	13	147
		(46)	(67)	--	(72)	(27)	--	--	(27)	(81)
Total	Jun 14-Nov 14	4,168	1,934	4,137	2,711	4,143	3,448	3,678	4,922	Grand total:
Pooled total estimate		4,222	1,954	3,919	2,769	4,205	3,484	3,635	5,035	29,222
		(1,116)	(565)	(931)	(881)	(1,011)	(920)	(1,061)	(1,355)	(7,840)
Estimated hours per kilometer		459	611	576	1,319	914	942	438	382	572

Appendix G. Creel census statistics collected on the Big Wood River, June to November, 1986.

Section	Interval	Anglers interviewed	Hours fished	Total fish			Catch rate (fish/hour)			Harvest by species[a]		
				Harvest	Released					Hatchery	Wild	Brook
					Total	>300 mm	Harvest	Release	Total	rainbow	rainbow	trout
3	1	2	1.0	0	0	0	0	0	0	0	0	0
	2	19	9.70	0	9	0	0	0.93	0.93	0	0	0
	3	44	75.10	18	43	5	0.24	0.57	0.81	0	8	1
	4	11	8.25	12	3	0	1.45	0.36	1.81	12	0	0
	5	9	4.85	8	4	0	1.65	0.82	2.47	3	3	0
	6	7	14.25	18	12	3	1.26	0.84	2.10	14	4	0
	8	16	32.50	4	4	4	0.12	0.12	0.24	0	4	0
	9	11	15.00	5	5	2	0.33	0.33	0.66	1	4	0
	10	5	5.00	1	2	2	0.20	0.40	0.60	0	1	0
	Total	124	165.65	66	82	16	0.40	0.50	0.89	39	24	1
4	2	14	20.25	15	18	0	0.74	0.89	1.63	6	9	0
	3	13	14.80	7	6	1	0.47	0.41	0.88	2	5	0
	5	2	1.00	1	0	0	1.00	0	1.00	1	0	0
	6	1	2.00	6	2	0	3.00	1.00	4.00	0	0	0
	8	2	1.00	2	0	0	2.00	0	2.00	2	0	0
	11	1	0.50	0	0	0	0	0	0	0	0	0
	Total	33	39.55	31	26	1	0.78	0.66	1.44	11	14	0
6	1	4	6.75	2	16	0	0.30	2.37	2.67	0	2	0
	2	4	1.75	0	10	1	0	5.71	5.71	0	0	0
	3	1	3.00	0	4	0	0	1.33	1.33	0	0	0
	4	9	10.30	5	1	0	0.49	0.10	0.59	0	2	0
	5	14	25.05	9	11	0	0.36	0.44	0.80	0	2	0
	6	6	12.00	7	0	0	0.58	0	0.58	7	0	0
	7	7	18.80	8	15	3	0.43	0.80	1.23	3	5	0
	8	6	20.50	2	44	15	0.10	2.15	2.25	1	1	0
	9	7	14.50	1	14	2	0.07	0.97	1.04	0	0	0
	10	1	0.50	0	0	0	0	0	0	0	0	0
	Total	59	113.15	34	115	21	0.30	1.02	1.32	11	12	0

Appendix G, continued.

Section	Interval	Anglers interviewed	Hours fished	Total fish			Catch rate (fish/hour)			Harvest by species[a]		
				Harvest	Released					Hatchery rainbow	Wild rainbow	Brook trout
					Total	>300 mm	Harvest	Release	Total			
7	1	1	2.00	1	0	0	0.50	0	0.50	0	1	0
	2	3	11.50	5	2	0	0.43	0.17	0.60	1	3	0
	3	2	3.50	1	9	2	0.29	2.57	2.86	0	1	0
	4	5	9.70	11	5	0	1.13	0.52	1.65	1	5	0
	6	3	3.00	0	0	0	0	0	0	0	0	0
	7	12	16.55	5	37	3	0.30	2.24	2.54	2	1	0
	8	9	14.15	2	23	9	0.14	1.63	1.77	0	1	0
	9	8	8.30	0	12	5	0	1.45	1.45	0	0	0
	10	4	4.75	0	2	2	0	0.42	0.42	0	0	0
	Total	47	73.45	25	90	21	0.34	1.23	1.57	4	12	0
8	1	14	16.85	16	1	0	0.95	0.06	1.01	14	2	0
	2	9	13.33	12	1	0	0.90	0.08	0.98	5	4	0
	4	15	26.25	9	20	0	0.34	0.76	1.10	8	1	0
	5	18	18.70	2	14	3	0.11	0.75	0.86	2	0	0
	7	1	1.00	1	0	0	1.00	0	1.00	1	0	0
	8	12	21.25	6	28	18	0.28	1.32	1.60	2	3	0
	9	4	13.70	3	1	0	0.22	0.07	0.29	3	0	0
	10	1	0.50	0	0	0	0	0	0	0	0	0
	Total	74	111.58	49	65	21	0.44	0.58	1.02	35	10	0
10	1	5	16.35	9	0	0	0.55	0	0.55	6	3	0
	2	14	8.41	7	2	0	0.83	0.24	1.07	5	2	0
	3	8	11.75	4	17	3	0.34	1.45	1.79	4	0	0
	4	7	7.25	9	0	0	1.24	0	1.24	8	1	0
	5	10	3.55	3	9	0	0.85	2.54	3.39	3	0	0
	8	2	1.75	1	0	0	0.57	0	0.57	0	1	0
	9	1	1.00	0	3	0	0	3.00	3.00	0	0	0
	10	1	1.00	0	0	0	0	0	0	0	0	0
	Total	48	51.06	33	31	3	0.65	0.61	1.26	26	7	0

Appendix G, continued.

Section	Interval	Anglers interviewed	Hours fished	Total fish			Catch rate (fish/hour)			Harvest by species[a]		
				Harvest	Released					Hatchery	Wild	Brook
					Total	>300 mm	Harvest	Released	Total	rainbow	rainbow	trout
11	1	1	3.00	0	4	1	Catch & release	1.33	1.33	------Catch-and-release-----		
	2	6	4.60	0	17	0	"	3.70	3.70	"		
	3	3	1.35	0	5	0	"	3.70	3.70	"		
	4	9	17.50	0	27	7	"	1.54	1.54	"		
	5	2	4.50	0	19	8	"	4.22	4.22	"		
	6	14	9.85	0	29	1	"	2.94	2.94	"		
	7	2	0.50	0	0	0	"	0	0	"		
	8	4	4.50	0	0	0	"	0	0	"		
	9	4	9.50	0	5	4	"	0.53	0.53	"		
	10	3	3.00	0	2	1	"	0.67	0.67	"		
	11	5	3.15	0	12	4	"	3.81	3.81	"		
	Total	53	61.45	0	120	26	"	1.95	1.95	"		
12	1	4	9.50	7	1	0	0.74	0.11	0.85	7	0	0
	2	15	12.85	1	0	0	0.08	0	0.08	0	0	0
	3	2	6.00	6	1	0	1.00	0.17	1.17	0	0	0
	4	12	15.90	6	0	0	0.38	0	0.38	4	0	0
	5	21	35.75	23	10	1	0.64	0.28	0.92	10	6	0
	6	2	3.00	5	0	0	1.67	0	1.67	0	0	0
	7	2	3.00	0	0	0	0	0	0	0	0	0
	8	4	1.90	2	0	0	1.05	0	1.05	2	0	0
	9	2	3.50	3	3	0	0.86	0.86	1.72	3	0	0
	Total	64	91.40	53	15	1	0.58	0.16	0.74	26	6	0
Grand total		502	707.29	291	544	110			1.18	152 (64%)	85 (35.6%)	1 (0.4%)

[a]Includes only observed fish.

Appendix H. Creel census statistics collected on the Big Wood River, December to March, 1986 to 1987.

Section	Anglers interviewed		Hours fished	Method			Harvest[a]		Total fish			Catch rate (fish/hour)		
	Resident	Nonresident		Bait	Lure	Fly	Hatchery rainbow	Wild rainbow	Harvest	Released		Harvest	Release	Total
										Total	>300 mm			
1	2	0	4.00	0	0	2	0	0	0	0	0	0	0	0
3	18	1	20.00	8	0	10	0	1	5	11	9	0.25	0.55	0.80
4	2	0	1.00	2	0	0	0	0	2	0	0	2.00	0	2.00
5	7	0	6.50	3	0	3	0	0	0	8	1	0	1.23	1.23
6	7	0	10.50	5	0	2	0	0	0	4	2	0	0.38	0.38
8	5	3	14.00	4	0	2	1	7	8	1	0	0.57	0.07	0.64
9	1	0	1.00	1	0	0	0	0	2	0	0	2.00	0	2.00
10	2	1	6.30	1	0	2	3	0	3	12	5	0.48	1.90	2.38
11	13	1	18.55	0	0	14	0	0	0	35	9	0	1.89	1.89
Total	57	6	81.55	24	0	35	4	8	20	71	26	0.25	0.87	1.12

[a]plus 3 mountain whitefish.

Appendix I. Estimated angler effort (hours) by census interval on catch-and-release (CR) and general regulation sections of the Little Wood River, 1986 (95% confidence intervals in parentheses).

Interval	Beginning	Section 1 (1.6 km) general regulations	Section 2 (4.4 km) (CR)	Section 3 (6.8 km) general regulations
1	Jun 14	165 (161)	124 (210)	309 (357)
2	Jun 28	294 (135)	169 (161)	378 (230)
3	Jul 12	185 (140)	135 (132)	380 (218)
4	Jul 26	446 (368)	97 (99)	247 (146)
5	Aug 9	590 (174)	102 (87)	144 (137)
6	Aug 23	49 (44)	153 (123)	124 (110)
7	Sep 6	318 (227)	50 (101)	427 (331)
Total	Jun 14-Sep 19	2,047	830	2,009
Pooled total estimate		1,986 (591)	938 (407)	1,998 (556)

Appendix J. Creel census statistics collected on the Little Wood River, June to November, 1986.

Section	Interval	Anglers		Hours	Method				Fish		Trout harvest by species	
		Resident	Nonresident	fished	Bait	Lure	Fly	Multiple	Harvested	Released	Brown	Rainbow
1	2	5	2	48	7	0	0	0	20	8	12	6
	3	10	4	22	2	0	8	4	5	27	5	0
	4	3	0	3	2	0	1	0	0	0	0	0
	5	10	6	26.9	6	1	7	2	7	12	5	2
	6	6	0	8.5	1	1	4	0	0	2	0	0
	7	9	0	19.0	5	4	0	0	7	1	5	1
	Total	43	12	127.4	23	6	20	6	39	50	27	9
2[a]	2	8	0	8.2	-	-	8	-	-	8	-	-
	3	0	1	2.0	-	-	1	-	-	8	-	-
	5	1	0	6.0	-	-	1	-	-	8	-	-
	6	7	3	25.0	-	-	10	-	-	18	-	-
	7	3	0	6.0	-	-	3	-	-	3	-	-
	Total	19	4	47.2	-	-	23	-	-	45	-	-
3	1	4	2	4.0	4	0	2	0	0	8	0	0
	2	28	3	70.5	18	3	9	1	22	15	10	2
	3	15	1	24.25	11	0	5	0	3	27	3	0
	4	6	1	11.25	6	0	1	1	0	0	1	0
	5	2	0	2.75	1	0	1	0	0	0	0	0
	6	7	0	17.5	2	2	3	0	2	3	1	1
	7	12	0	36.0	5	0	7	0	4	7	1	0
	Total	74	7	166.25	47	5	28	2	31	60	16	3

[a]Catch-and-release regulations.

Appendix K. Surface area (m^2) of various habitat types in electrofishing reaches on the Big Wood River, 1986.

	Habitat types										
Reach	Back water pools	Convergent channel pools	Dammed pools	Glides	Lateral scour pools	Plunge pools	Riffles	Rapids	Secondary channel pools	Steep riffles	Total
1	0	0	156.4	6,735.4	5,346.4	0	9,662.2	428.2	862.6	0	23,191.2
2	224.4	61.0	0	1,553.3	7,481.0	485.6	31,678.8	1,689.3	1,054.7	0	44,228.1
3	184.0	0	0	573.2	6,623.7	110.0	13,800.9	970.0	0	1,181.7	23,442.9
4	257.3	0	0	7,114.6	7,854.9	57.5	16,767.5	1,351.3	567.9	521.7	34,492.7
5	260.6	27.3	0	1,475.1	4,972.8	0	8,442.9	0	235.9	0	16,097.7
6	337.8	143.8	0	812.4	4,899.0	158.4	10,238.0	542.4	50.7	0	17,181.5
7	127.0	0.0	0.0	1,600.7	3,500.2	0.0	7,000.6	163.8	104.2	310.4	12,806.9
Totals	1,385.5	232.1	156.4	19,864.7	40,677.0	811.5	97,590.9	5,829.1	2,876.0	2,013.8	171,441.0
Percent	0.8%	0.1%	0.1%	11.6%	23.7%	0.5%	56.9%	3.4%	1.7%	1.2%	

Appendix L. Surface area (m^2) of various cover components in electrofishing reaches on the Big Wood River, 1986.

Reach	Roots	Brush	Debris jams	Grass	Large debris	Riprap	Root wads	Small debris	Stumps	Trees	Undercut banks	Totals
1	162.6	94.8	360.3	3.4	220.8	37.5	130.3	156.3	0.0	29.7	69.2	1,264.9
2	354.5	527.5	240.6	6.5	388.4	184.4	277.2	74.3	2.0	6.0	393.5	2,454.9
3	186.5	43.1	22.1	3.1	246.7	0.0	106.0	9.0	4.9	0.0	102.3	723.7
4	171.1	63.5	129.8	49.9	230.5	340.3	81.0	147.4	0.0	9.6	162.0	1,385.1
5	134.3	36.0	79.4	0.7	205.5	140.9	84.7	80.9	0.0	20.8	1,01.9	1,385.1
6	109.6	31.2	188.0	2.6	346.2	303.7	43.2	152.7	1.5	0.0	165.7	1,344.4
7	56.8	222.7	0.0	19.0	6.6	0.0	17.3	298.2	1.0	0.0	178.4	800.0
Totals	1,175.4	1,018.8	1,020.2	85.2	1,644.7	1,006.8	739.7	918.8	9.4	66.1	1,173.0	8,858.1
Percent	13.3%	11.5%	11.5%	1.0%	18.6%	11.4%	8.3%	10.4%	0.1%	0.7%	13.2%	

Submitted by:

Russ Thurow
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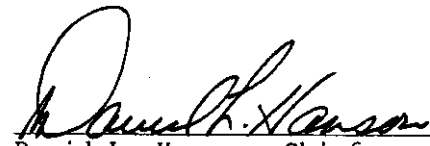
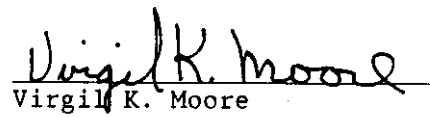
Approved by:

IDAHO DEPARTMENT OF FISH & GAME

Jerry M. Conley, Director



David L. Hanson, Chief
Bureau of Fisheries



Virgil K. Moore
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